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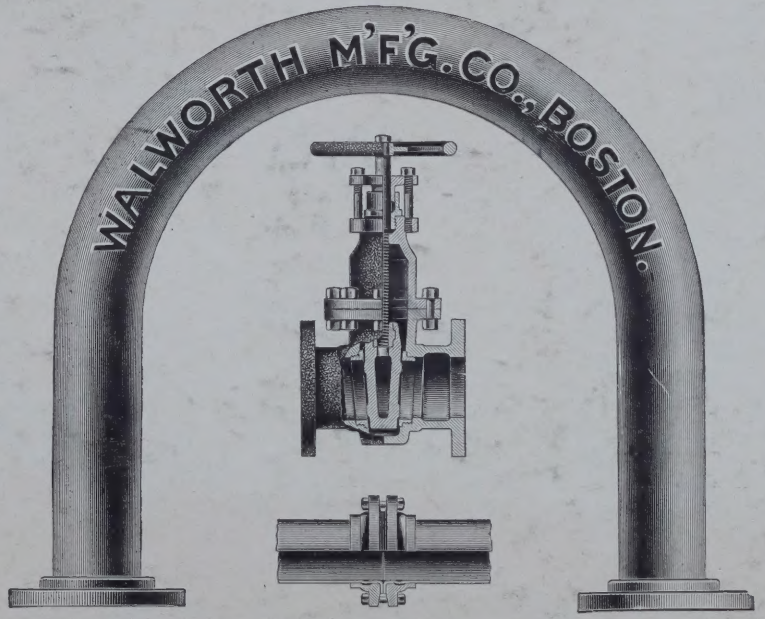

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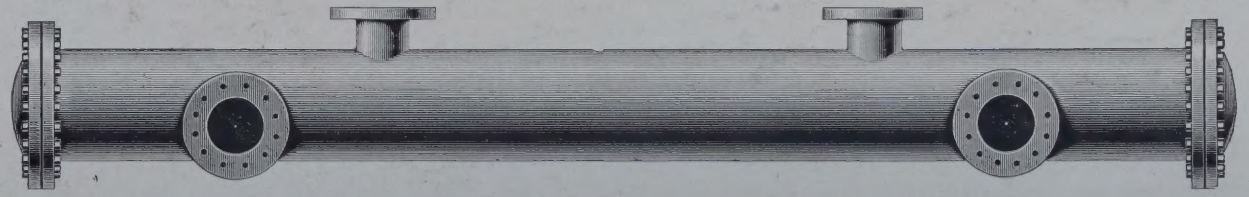

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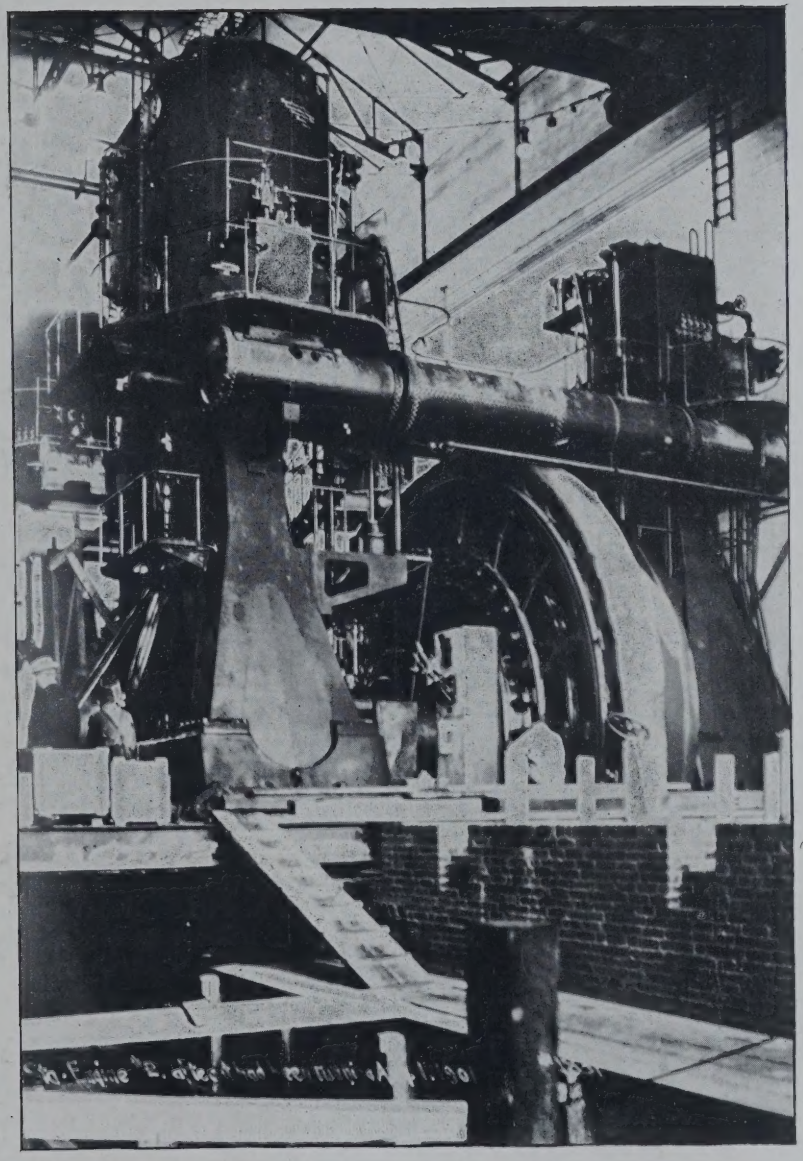

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International Railway, Buffalo, N. Y.
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Underground Electric Railway Co., London, England
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Lake Shore Electric Railway, Toledo, Ohio
Northwestern Elevated Railway, Chicago, Ill.
Seattle & Tacoma Interurban Railway, Seattle, Wash.
Fonda, Johnstown & Gloversville Ry., Gloversville, N.Y.
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Wilkesbarre & Hazelton Railway, Wilkesbarre, Pa.
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Brooklyn Rapid Transit Company, Brooklyn, N. Y.
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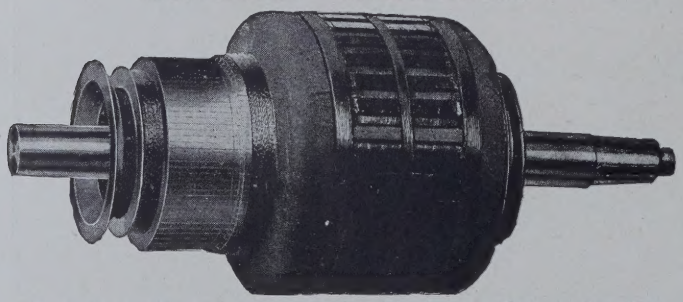

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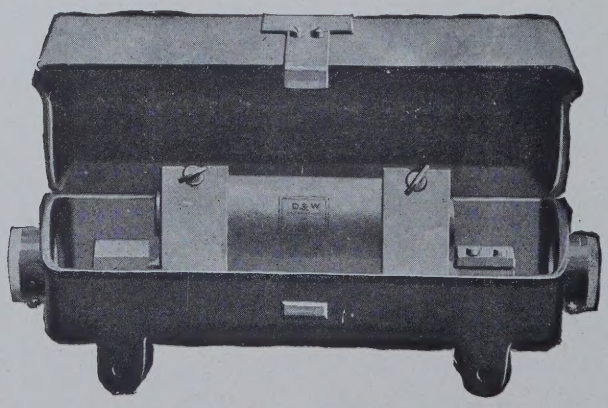

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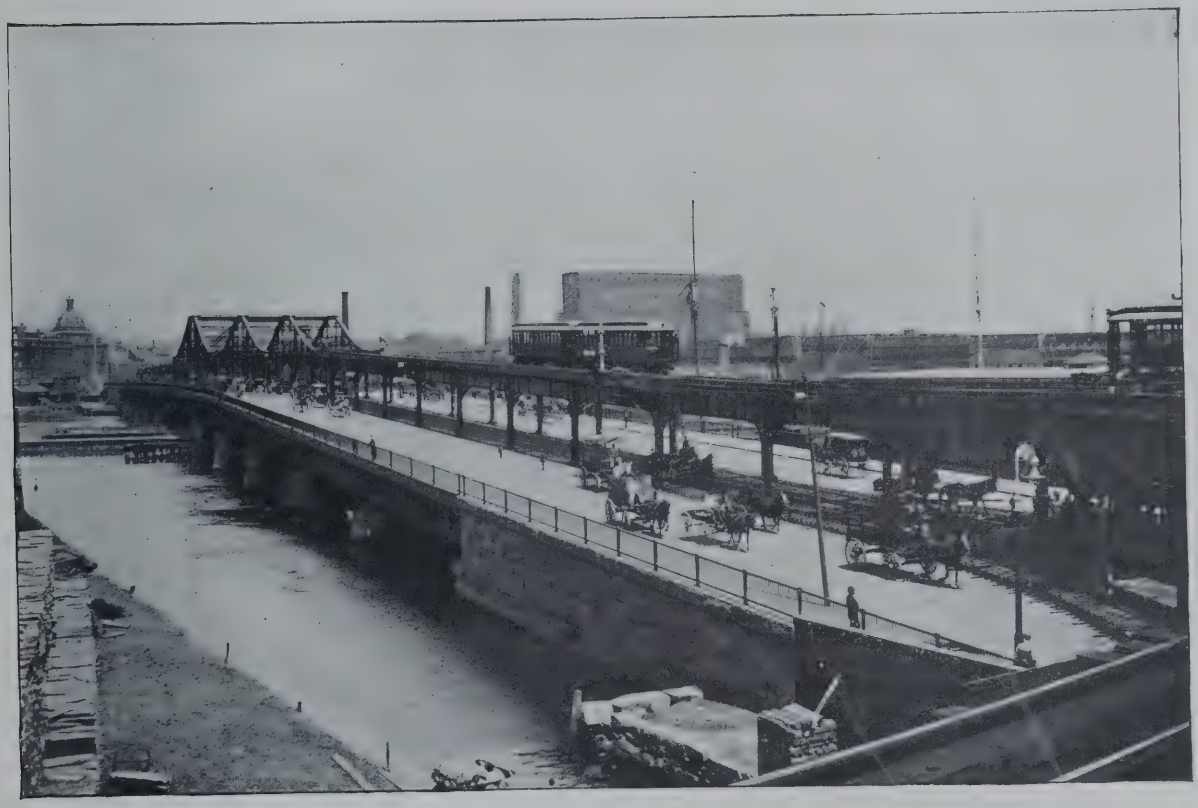

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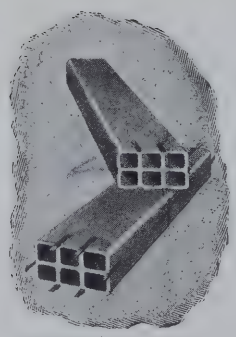

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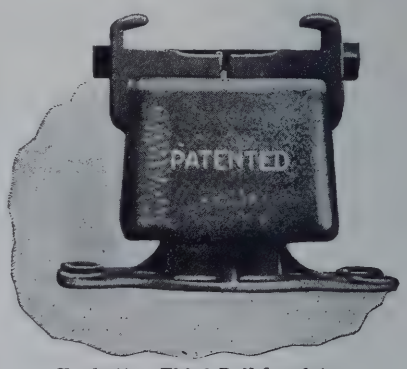

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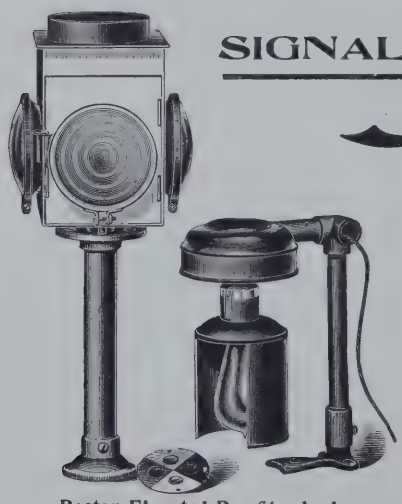

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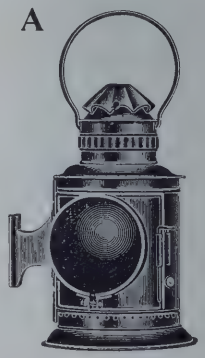

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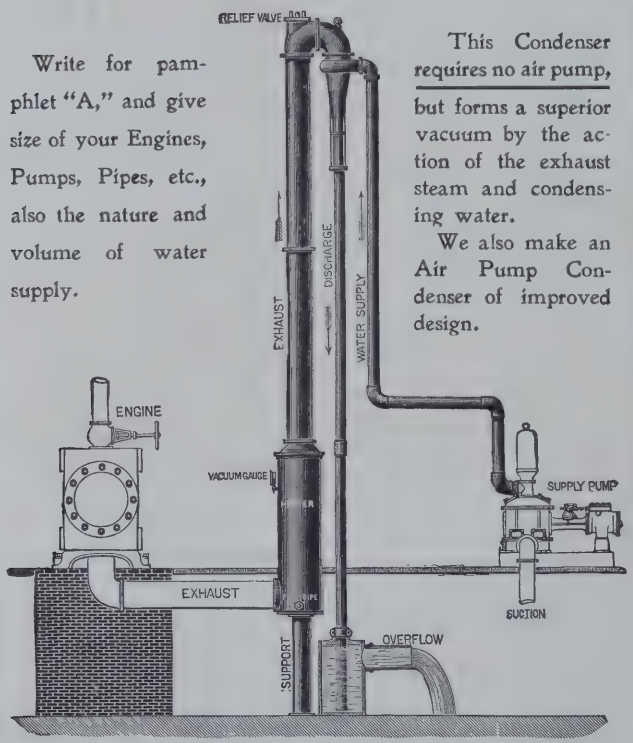

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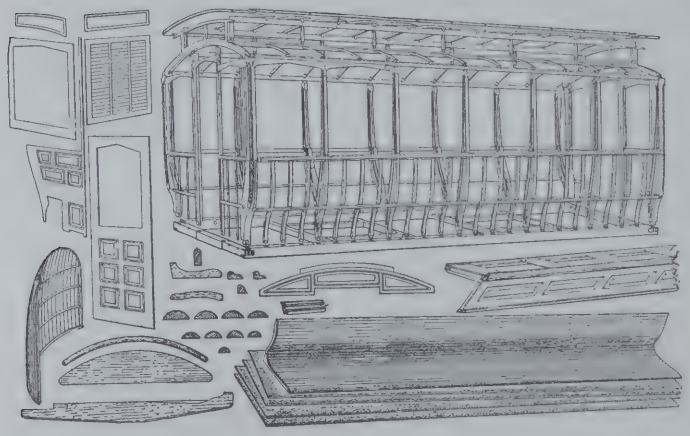

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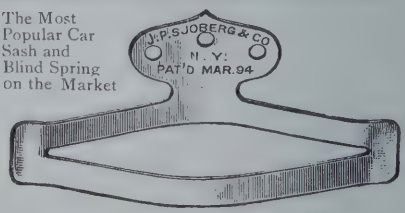

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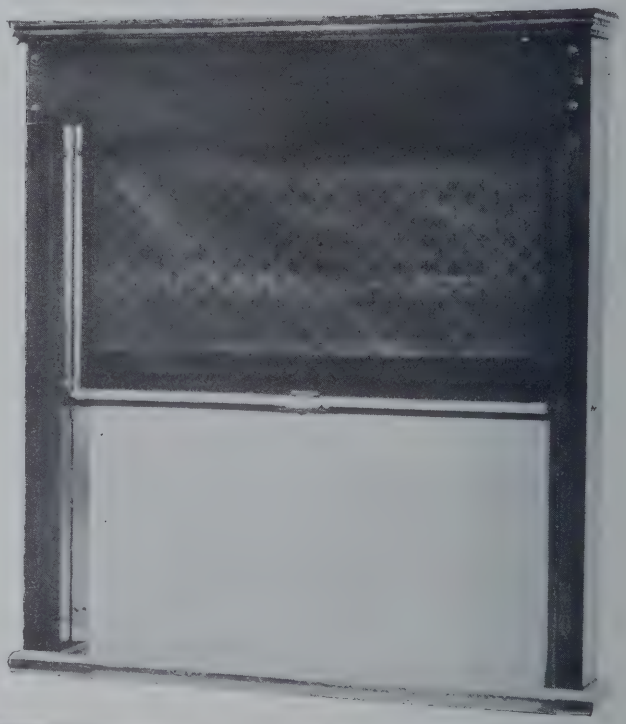

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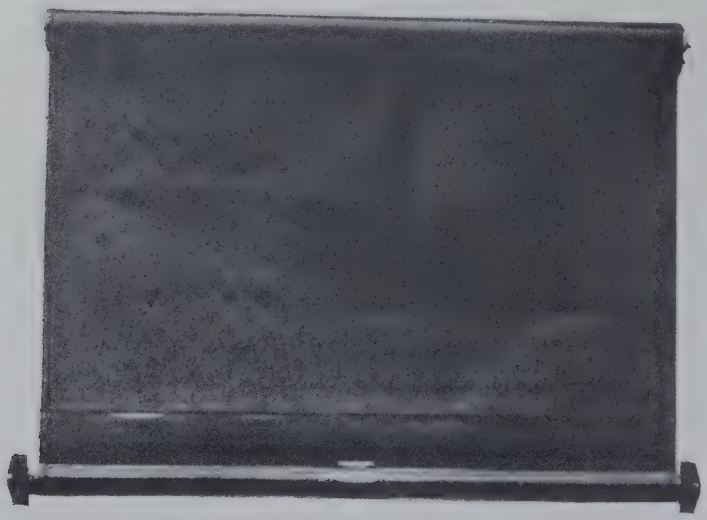

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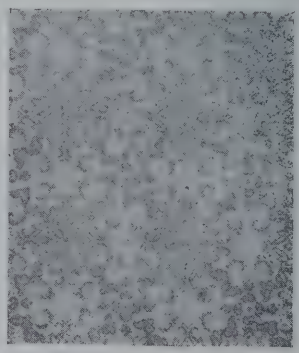

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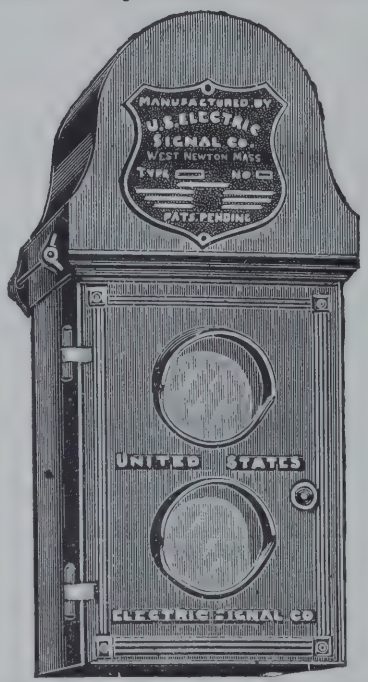

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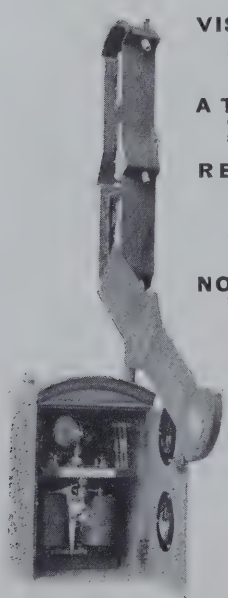

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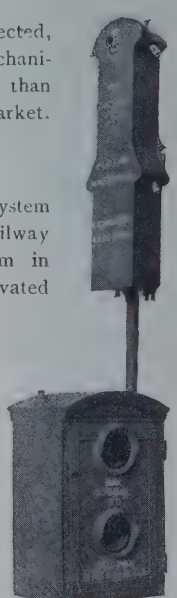

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MAJ. GEN. WM. A. BANCROFT,
President, Boston Elevated Railway Co.

Boston's First Street Railroad.

THE first "horse railroad," and what no doubt gave the cue to the pioneers of street railway transportation in Greater Boston, was a line from Harvard University in Cambridge to the Fitchburg Railroad at Union Square, Somerville. It was a unique affair, its equipment consisting of a steam passenger coach, which had seen better days, and which had been relegated to this service long after it had passed the period of usefulness behind the iron horse. The length of the road was about one and one-half miles, and its trips were scheduled to connect with the passenger trains on the Fitchburg Railroad. It was not a chartered institution, but the enterprise of one man, John C. Stiles.

The first street railway corporation to receive a charter from the Massachusetts Legislature was the Dorchester and Roxbury in 1852, and the incorporators named were William D. Swan, Charles C. Holbrook and William Hendry. Then followed an epidemic of street railway incorporation. On May 21, 1853, the Metropolitan Railroad received a charter to operate from the old Boylston market, corner of Boylston and Washington streets, to Eliot square, Roxbury.

The Cambridge and Boston line was granted in 1853; the Middlesex Railroad between Charlestown and Boston in 1854; the Broadway Railway, from South Boston Point (now City Point), in April of the same year; the Boston and Chelsea charter was also granted in 1854; the Dorchester Avenue Railway Company in 1854 was swallowed up by the Dorchester Railroad in 1858; the Lynn and Boston was incorporated in 1859, followed by the Winthrop road in East Boston in 1861; Chelsea

and East Boston were connected by charter May 5, 1863; Brookline and Back Bay in 1868; the Highland street railway in April, 1872, and the Charles River Railroad in 1881.

The latter road, after two or three years of struggling for existence, was consolidated with the Cambridge Railroad. One by one these railroads consolidated, and on November 11, 1887, the final consolidation, under the name of the West End Street Railway Company, took place. One of the first things considered by the directors of the West End Company was the adoption of some new motive power in order to gain room on the street by the disuse of horses. Nearly 10,000 horses were required at that time.

Electricity became a possible factor in transportation. The West End was not slow to recognize its power. In 1888 the overhead system of electric propulsion was inaugurated on the Back Bay cars. From its inception electricity spread over the lines of the West End Company almost too rapidly for people to understand its merit. With the inception of electricity the horse as a motive power was a mark for relegation.

The last century began with stage coaches and traveled via omnibus, "bobtail" horse car, electric, to the palace car of the Boston Elevated, through the subway, so the twentieth century rapid transit has made history in the past 15 years. Before then it was slow transit.

The first location granted the Metropolitan Railroad Company was from the old Boylston market, corner of Boylston and Washington streets, Boston, to Eliot square, Roxbury. Early in the 50's a corporation was formed and named the Metropolitan Street Railway Company. By September, 1856, a line of rails was laid in Washington street. On the 16th of September two street cars were received from Troy, N. Y. There were no car houses, stables or horses in the company's possession, and for a time the cars were left out over night. September 17 the statue of Franklin, in front of city hall, was dedicated, and a big trades procession preceded it, in which appeared one of the new cars, representing the Metropolitan Road. It was hauled in the procession by horses owned and

driven by Owen Nawn. At 6 o'clock in the morning that car started on its first trip. Clark Scates, then a teamster on Harrison avenue, hitched his horse to the car and was the original driver, and Martin S. Starkweather acted as conductor. Mr. Starkweather was relieved by John Guild, and in the evening he was succeeded by Ivory Hall,who remained on duty until midnight. On the 18th the second car, which the day before had appeared in the Franklin procession, was put on. Three or four days later a third car was received and was placed in charge of Almon Warner. New cars were added from time to time as the road prospered and new lines were built. The cars were always crowded and receipts for each car were about $25 a day; in fact the road reported over 8,000,000 paying passengers for its first year's work. The success of the Metropolitan and Cambridge railways speedily led to the construction of others. The charter of the Middlesex Railroad was granted April 29, 1854.

The fight to obtain a location in the city of Boston was a long and bitter one, but on March 6, 1857, the first car was run from Charlestown Neck to the corner of Charlestown and Tillman streets in the city proper, the rails being of cast iron and only eight feet in length.

After the road's extension to Dock square through Cornhill, which was finally effected after paying the city of Boston $10,000 for the cost of changes on Sudbury street and the widening of Union street, "bobtail" cars made the circuit from Bunker Hill to Dock square, when, instead of changing the horses to the other end of the car for the return trip, the car swung around, the body of it being hung upon a center pivot. April 30, 1858, the company was permitted to cross Charlestown bridge without the payment of toll thereafter, and a year later the restriction was removed from Malden bridge. The subsequent history of the Middlesex Street Railroad up to the time of its consolidation with the Highland Road was one of unexampled prosperity.

The charter of the Broadway Railroad Company was granted on the same date as that of the Middlesex company. The location of its route was from South Boston Point (now City Point) to a spot near the inter-

section of Broadway and Turnpike street, (now Dorchester street), for the purpose of forming a junction with the Dorchester Avenue Railroad. The business was continued from the time it commenced operations, which was four years after the granting of the charter, until May 25, 1868, when an act was passed by the legislature changing its name to that of the South Boston Railroad.

The Boston & Chelsea Railroad Company was chartered in 1854 to construct lines in Chelsea and connect with the Middlesex road in Charlestown. This road first assumed importance on being leased to the Lynn & Boston Railroad Company, which obtained a charter in 1859. The Lynn & Boston is the only street railway in Boston which is not a part of the Boston Elevated system. It reaches its terminus in the city at Scollay square by way of Charlestown and extends in a northerly direction to Marblehead and Salem, and makes connections with other street railways running to various parts of the state.

The Dorchester Railway Company succeeded the Dorchester Avenue Railway Company in January, 1858, by decree of the supreme judicial court, the company failing to meet the provisions of its charter, which was granted in 1854.

All subsequent locations were granted the Dorchester railway as successors of the Dorchester Avenue Railway Company. It is related of the latter organization that it was equipped at one period of its brief existence with double deck cars, and that after passing through a series of discouraging annoyances by its competitors was compelled to wind up its affairs on account of an accident to four of its passengers, who in some way tumbled from the top of the car on which they were riding and then sued the company for damages. The property and franchise of the Dorchester Railway Company passed into the hands of the Metropolitan Company October 1, 1863.

The Suffolk Railroad Company was incorporated April 30, 1857, to construct lines in East Boston and in the city to run from East Boston ferry through Hanover street to Scollay square and thence to extend to

the Metropolitan tracks in Boylston street.

The Chelsea & East Boston Road, chartered May 5, 1863, laid tracks from Chelsea, connecting with the Suffolk Railroad in East Boston, and this road was consolidated with the Metropolitan in 1865, the Suffolk having been absorbed by the same company the previous year.

The Dorchester Extension Railway Company was organized by Henry L. Pierce, Asaph Churchill and E. H. R. Ruggles, and received a charter Feb. 18th, 1859, to build a line from a point near the Lower Mills in Dorchester to connect with the (then) terminus of the Dorchester Railway at Center street in that town. Another street railway, called the Winnisimmet Horse Railway, received its charter May 26, 1857, and its route was from that portion of Chelsea called Prattville, over the Winnisimmet ferry and the tracks of the Middlesex Railroad to "Scollay building" in Court street. The Metropolitan absorbed these roads in 1863 and purchased the franchise of the Brookline & Back Bay Road in 1868. This latter company had tracks leading from Brookline village to Roxbury Crossing, and by means of its charter the Metropolitan Road acquired the right to obtain locations in Brookline. In like manner the Middlesex Road absorbed the Somerville Horse Railroad Company, the Medford & Charlestown Railroad Company, the Malden & Melrose Railroad Company and the Cliftondale Railroad Company. The Cambridge Railroad Company acquired in the same way tracks in Arlington, Watertown, Newton and Brighton.

The Middlesex road, whose earliest terminus was near Haymarket square, soon obtained permission to run its cars to Scollay square, and the South Boston road, whose early terminus was Summer street, speedily obtained the right to run to the same point; and, after a stubborn fight, the Cambridge company obtained the privilege for its East Cambridge cars, which passed the northern depots. Thus all the railways met at the old Scollay building, which was employed as a transfer station, and the legislature made a limited provision for commutation checks to be there used. When that building was removed the Middlesex and South Boston

roads obtained the right to run to the southern and northern depots respectively. Charlestown, meanwhile, had become a part of Boston, so both of these roads had direct influence in the board of aldermen. Cambridge, being an independent city, had no such influence, and it is fair to say that its Bowdoin square cars were kept at that point by the narrowness of Court street. That company did, however, obtain the right to run through Charles street to Park square.

On April 12, 1872, the Highland Street Railway Co., which, by the way, was the first to be chartered under the name of "railway" instead of "railroad," was chartered for the avowed purpose of competing with the Metropolitan in the business of its original line between Roxbury and the city proper. And in 1881, the Charles River Street Railway Co., consisting of Samuel L. Montague, Charles E. Raymond, D. U. Chamberlain, Edmund Reardon, W. S. Swan, H. O. Houghton, J. M. W. Hall, Henry F. Woods and others, was chartered to compete with the Cambridge Railroad on its original line of West Boston bridge. The termini of the Highland Railway were Grove Hall in the Roxbury district, and Temple place in the city proper. It was the best equipped of the several street car lines, its cars being handsome specimens of this class of architecture, and their bodies were ornamented with the conventional plaid of the Scotch Highlanders, in the center of which on either side was a panel representing some historical scene or a portrait of some one of the Massachusetts governors for whom the car was named. It was the first to uniform its employes, adopting for this purpose a gray cloth similar to that of the letter carriers' uniforms. It was a well managed corporation, exacting the strictest courtesy from its employes towards the patrons of the road, in return for which it paid liberal salaries and otherwise encouraged those who held subordinate positions. The principal tracks of this road were on Shawmut avenue, Blue Hill avenue, Columbus avenue, Dudley and Warren streets. Its lines were never pecuniarily profitable uutil long after the company had passed out of existence.

The Charles River street railway company, chartered in 1881, with

Charles E. Raymond as president, had a hard battle for existence. At the time of the general consolidation in 1887 the South Boston road was actually running more miles upon the tracks of the Metropolitan company than upon its own, and one of its lines, known as the "Blue Line," only ran a few blocks on the South Boston tracks, but made a circuit on the Metropolitan tracks through the business portion of the city. In 1886 an act was passed by the legislature authorizing the street railways running cars in or into the city of Boston to consolidate. This legislation was obtained owing to the efforts of the Highland and Charles River companies, which had found competition unprofitable. By virtue of this act the Cambridge and Charles River roads consolidated immediately under the old name of the Cambridge railroad company, and shortly afterwards the Highland and the Middlesex companies united under the name of the Boston Consolidated Street Railway company.

In the fall of 1886 two new street railway companies were formed under the general laws by the same men, the West End and Suburban. The original incorporators started as a land company, with the design of uniting Beacon street, Boston, and Beacon street, Brookline, and widening the street in Brookline into a boulevard, and thus enhance the value of the land owned by them along the route. In order to make this land marketable it was necessary to provide transportation facilities, and at the outset these two railways were incorporated, and the West End railway obtained immediately the right to enter Boston through the new avenue and the Back Bay.

The Metropolitan company opposed the new railway, but the advantages of the new line to the public were evident and irresistible. The two pioneer roads, the Metropolitan and the Cambridge, had always been friendly, and while these events were taking place a plan to consolidate the two companies was formed and the details arranged. This alarmed the West End management, and they suddenly formed the purpose of buying a controlling interest in the stock of all the old roads except the Lynn & Boston, and uniting them. In a few weeks they had acquired enough of

the stock to be masters of the situation, and shortly afterwards obtained from the general court the necessary legislation to bring about this general consolidation, and the roads were merged under the management of the West End street railway company on November 11, 1887.

After the passage of the "West End" bill by the legislature, Mr. Calvin A. Richards, then at the head of the Metropolitan road, showed his appreciation of the consolidation scheme by being the first to exchange his shares of Metropolitan for the preferred stock of the West End company, on the basis proposed by the latter to the various street railways which was as follows:

One and one-fourth shares of West End preferred for each share of Metropolitan, equivalent to increasing Metropolitan shares from 40,000 to 50,000; 119.39 shares of West End preferred for each share of Cambridge, equivalent to an increase of from 19,500 (par 100), to 29,000 (par 50); South Boston, 15,000 to 18,750; Consolidated (Middlesex & Highlands) from 17,000 (par 100), to 30,000 (par 50).

One of the first things considered by the directors of the West End company was the adoption of some new motive power, in order to gain room on the street by the disuse of horses. Long-continued and costly experiments with storage batteries were tried without success. Then careful investigation was made of the cable system. While this question was under discussion it was reported that the overhead electric system had been proved a success in Richmond, Va.. and on investigation this report was so substantial that the West End company determined to try that system on its new line on Beacon street. Considerable opposition to the granting of the rights to use overhead wires was made, but was finally overcome by an agreement to use underground conduit for carrying the wires in the Back Bay. This conduit proved a failure, but the overhead system gave so much satisfaction that a general right to use it in Boston was granted in 1889. In 1897 the West End street railway company leased its property to the Boston Elevated railway company.

An Era of Progress.

There is no locality where greater changes have been wrought by street railways than in Boston and its suburbs. At the time of the advent of street cars in 1856, Charlestown, Roxbury, West Roxbury, Dorchester and Brighton were independent municipalities. Cambridge was a city of 20,000 inhabitants. All the bridges leading into Boston were toll bridges, and the Malden and Chelsea roads, and perhaps others, were turnpikes upon which tolls were charged. In order to free the bridges to Cambridge, the Cambridge railroad company paid $32,000. For the privilege of using Craigie's bridge this company paid into the treasury of Boston $30 per year for each car run over that structure. At the time of the incorporation of the road, what is now known as the old West Boston bridge, at the foot of Cambridge street, was owned by a company called the Hancock Free Bridge Corporation, and all the cars were subjected to the payment of toll when passing between the two cities. The best service between Cambridge and Boston was a coach every half-hour during the business portions of the day, and this service, in its beginning, was irregular and uncertain. The service between Boston and Roxbury, Charlestown, and other suburban towns was little if any better.

The Dorchester and Roxbury Railroad Company was the first to receive a charter. In 1852 a petition for a charter to form a horse railway company was presented to the legislature, and not more than 3,000 persons signed a petition in aid of it. The first company, consisting of William D. Swan, Charles C. Holbrook and William Hendry, and known as the Dorchester & Roxbury Railroad Company, received a charter in 1852. But it was not until May 30, 1857, that the road was built.

In 1853 the Metropolitan Railroad Company, consisting of J. P.

Ober, Moses F. Fowler, Henry N. Hopper and others, and the Cambridge Railroad Company, organized by Gardner G. Hubbard, Charles C. Little, Isaac Livermore and their associates, were incorporated to connect Boston with Roxbury and Cambridge respectively. The Metropolitan charter then granted turned out to be defective, and no action was taken under it until after it had been amended the following year, but the Cambridge company was formed at once and obtained its first location in Boston, on Cambridge street to Bowdoin square, December 4, 1854, and was so operated for 5 years.

Capitalists felt great distrust of the enterprise, claiming that there was hardly business enough to support the coach lines, and the contractor who built the original tracks between Harvard square, Cambridge, and Bowdoin square, Boston, and who took his pay in stock at par at the rate of $30,000 per mile became insolvent owing to the decline of the stock to less than $50 per share. The original stockholders were unwilling to advance the necessary funds for equipping the road when built, and a new corporation, consisting of John C. Styles, Moses M. Rice, T. Russell Jencks and others, under the name of the Union Railway Company, was chartered for the purpose, with authority to lease the tracks of the Cambridge railroad. This company got rid of much of their trouble by buying the omnibus franchise, and March 26, 1856, the first street car in Boston was run from the junction of Pearl and Main streets, Cambridgeport, to junction of Cambridge and West Adam streets, Boston, and shortly afterwards the line was running regularly between Harvard and Bowdoin squares. The first "horse" railroad was a unique affair.

In 1849 there were some twenty-two different routes of omnibus lines, which covered a good share of the territory now reached by the Boston Elevated Railway system; but in place of the uniform fare of five cents per passenger, which is at present in force, the passenger was charged a fare of thirty-one cents between Medford and Grove Hall, or thirty-seven and one-half cents between Brighton and Chelsea. From Brookline to Boston the cash fare was eighteen and three-quarter cents, with an hourly

omnibus only a portion of the day. Even Old Cambridge fares were ten cents, and 'buses only ran hourly from 8 A. M. to 8 P. M., with no facilities for belated collegians or citizens to reach their homes except by hackmen. Roxbury could boast of six lines, if we include the Jamaica Plain and Dorchester 'buses, which pass through a portion of Roxbury. Fares were twelve and one-half cents to as low as sixteen for one dollar; and, with the Canton street and Dover street lines in operation, Washington street below Dover street must have presented some indications of even its present degree of activity.

The last trip made by a horse car in Boston was over the Marlboro street line, Monday, Dec. 24, 1900.

Keeping pace with the advance in the uses of electricity, the West End Street Railway Company was empowered by the legislature in 1887 to consolidate with any or all the companies authorized to run cars in the city at that time, and was also given the right to install an electrical system for the operation of its cars, in the same act, which was speedily carried out. The advent of this motive power met with determined opposition from those who looked upon it as a menace to life and limb, and it was not until its introduction had been accepted as a positive advantage over horse power that the hostility ceased, and the electric cars developed into an important element in the progress of the century.

In 1890 an act was passed by which the West End was authorized to construct elevated railways, but that company never took advantage of its rights.

With the growth of Boston and the extraordinary demands for transportation, there resulted a serious congestion of the business centre, which called for some kind of relief. During the administration of Mayor Matthews the construction of a subway was advanced as a partial solution of the trouble, and this took shape in the form of legislation passed in 1893 and 1894. Subsequently, the underground system was leased to the West End Street Railway, and in October, 1897, the Boston Elevated Railway Company absorbed the West End.

Development of Rapid Transit.

The successive stages in the development of rapid transit in Greater Boston were :

Horse-cars were introduced into Boston in 1856.

Various horse-car lines consolidated into the West End Street Railway in 1887.

Electricity given a trial as the motive power in 1887.

Electricity adopted as the motive power in 1888.

The West End Street Railway leased to the Boston Elevated Railway Co. in 1897.

Subway opened to passenger travel Sept. 1, 1897.

Elevated Railway opened to passenger travel June 10, 1901.

Everything that entered into the building of the "L" was up-to-date and no expense spared in giving Boston the finest example of elevated railway in this or any other country.

Estimated cost of the Boston Elevated Railway division, $10,000,000.

Number of tons of steel used in construction, 25,000.

Length of double track, six miles.

Length of single track, one-quarter mile.

Number of ties used on road-bed, 53,000.

Number of elevated cars, 150.

Chief Engineer appointed July, 1898.

First steel erected March 30, 1899.

Sullivan Square--Dudley Street section completed June 1, 1901.

First experimental train run from Sullivan Square Feb. 17, 1901.

First experimental train run through subway May 1, 1901.

First experimental train run from Pleasant Street to Dudley Street May 1, 1901.

First through train from Sullivan Square to Dudley Street May 10, 1901.

The "Atlantic" circuit of the Boston "L" opened to the public August 22, 1901.

Number of engineers employed in construction of "L" road, 84.

Number of workmen, 1700.

The Subway.

The subway, used by the Boston Elevated Railway Company, is a tunnel or underground passageway 9,498 ft. long, under several of the principal streets, built by the city and leased for a term of 20 years to the West End Street Railway Company. It is by far the largest underground passageway for railways in the world, the four-track portion having a cross-sectional area of 707 sq. ft.

After the introduction of electric traction the cars from all parts of Boston and its suburbs centered in one downtown district, one-quarter mile broad and about one mile long. The two main thoroughfares between the northern and southern portions of the city were Tremont street and Washington street, narrow and tortuous highways. No more serious difficulty ever presented itself to the street railway and municipal officials than the enigma of relieving the congested traffic in this small area. The Boston Transit Commission finally decided that a subway system would be the best solution. An appropriation of $7,000,000 was made for the work, but the cost was $1,500,000 less. The West End Railway Company, or its lesee, pays nearly 4 7-8 per cent. of the net cost of the subway, equipped the subway with tracks and apparatus, furnished all power used therein, and bears the expense of repairs and maintenance. The city sold 3 1-2 and 4 per cent. bonds and the surplus goes into the sinking fund. From the passage of the Subway Act by the legislature and its acceptance by the city in a special election in July, 1894, to the completion of the work there was a stubborn opposition to the project on sentimental as well as financial grounds, for it was considered an encroachment on the historic Common. The first spadeful of earth was removed in the presence of Governor Greenhalge, on March 28,

1895, and after 29 months of continuous and unremitting labor its completion was witnessed.

The 5.3 miles of single track are laid with 85-lb. T-rails, which are bonded with two No. 0000 wires and cross connected to 500,000-c. m. cables returning to the station. To avert any danger of derailment a 43-lb. steel guard is bolted to the inside of each rail. The foundation is of broken stone ballast, 12 to 20 inches deep, upon which chestnut ties are laid. Figure 8 trolley wire, with a cross section of 360,000 c. m., is carried in an inverted trough of cypress wood which is fastened to the iron work of the roof and insulated with sheet rubber. Hangers of special design are spaced 12 ft. apart. Drains are provided beneath the tracks which carry the water into wells, from which it is removed to the sewers by means of rotary pumps operated by electric motors, automatically started and stopped. To insure perfect ventilation 8-ft. fans, run by 500-volt motors, exhaust the air from the subway and deliver it to eight ventilating chambers leading to the exterior. The The whole underground construction is of stone, brick and iron.

For ordinary traffic about 5,500 car trips are made each way in the subway each day, and on the first day after the opening over 200,000 passengers were carried through it. G. G. Crocker was chairman of the Boston Transit Commission and H. A. Carson, the chief engineer.

Some of the tracks loop at three of the stations while the other continues through and provides for a continuous trip to and from any part of the city. Entrance to the platforms is had through stations which are built of granite with flights of steps leading to the ticket offices and platforms. The roofs of these stations are principally of glass and the stations were made as complete as the conditions would allow. The platforms are of artificial stone with suitable guard rails and wire fences for the protection and guidance of the passengers. Ticket offices are provided at each station and all subway passengers entering by the station are required to purchase tickets which are surrendered to ticket droppers at the platform entrances. At the stations the lining of the tube is of white enamelled brick, and the

stations are brilliantly lighted by arc and incandescent lamps.

At the Boylston St. Station is a cross sub-way, so that the southbound passengers after purchasing their tickets can pass under the tracks to the platform of the southbound cars. Uniformed attendants are stationed at the platforms to direct and care for passengers. The subway is lighted throughout by electric lamps and electric heaters are provided for warming the ticket offices. There is also an elaborate lock signal system. Perfect ventilation is secured by means of fans driven by electric motors with flues leading to ventilating chambers that communicate with the external air.

The Park St. Station of the subway is said to rank third among the busy railway stations of the world, although one of the smallest in platform capacity, having only 15,197 sq. ft. of available surface. This station is used as the general transfer point of the subway and in busy hours thousands of people transfer at this point while the number of tickets sold between the hours of 5 and 6 at night has been as high as 8,031, and the maximum number of cars passing in one hour is 250 surface cars, also "L" cars—120 per hour—on the inside loop, and 120 elevated train cars in each direction on the through tracks.

The number of tickets sold daily at this station is about 30,000. It is estimated that as many people leave the station during the day of 18 hours as enter it, and that a similar number transfer, so that is safe to say that as many as 100,000 people are daily accommodated at this station. Electrically operated indicators are in use during the hours of largest out-going traffic. These indicators have the names of the routes arranged in parallel columns and between these are illuminated numbers to indicate the berth at which the car will stop. This prevents the passengers from crowding to the edge of the platform to watch for their car. The subway was designed for use by surface cars and is not well adapted to the elevated trains that are now operated on the through tracks. As soon as a tunnel can be built for the elevated trains, they will be removed from the present subway.

Opening of the "L" Division.

The opening to passenger traffic of the Boston Elevated Railway Company's "L" division of five miles from Sullivan Square, Charlestown, through the subway to Dudley street was successfully inaugurated on June 10, 1901, and all Boston and the Metropolitan district took part in the great event, celebrating the installation of the new system of rapid transit, a question constantly receiving the attention of President Bancroft and the other officials of the Boston Elevated Railway Company. There was a general desire to take passage on each of the inaugural trains, one of which left Dudley Street about 5.30 o'clock and the other the Sullivan Square terminal at the same time. The guards were kept busy in seeing that the cars were not overcrowded, and the instances were frequent when it was necessary to use all their strength in preventing people from invading a crowded train. The opening of the "L" marked another and highly important and extremely beneficial stage in the development of rapid transit for Greater Boston.

A striking feature of the opening of the "L" was the immense number of passengers carried, the number being several hundred thousand. Every train was filled, and at the busy hours in the morning and evening each car was crowded.

Sullivan Square and Dudley Street terminals are good specimens of architecture, being fully adequate to care for the patrons who enter and leave the cars at these points. The stations along the lines are also models of neatness.

The "Atlantic circuit" of the Boston "L" opened to the public August 22, 1901. There was no ceremony connected with the opening of this section of the road.

While it was generally believed that the addition of the "L" service would mean an important reduction in the number of surface cars operated, just the opposite is the fact. There are now over 900 more trips run than heretofore, and there has been an increase of 10,000 miles a day in the distance run. However, many of the old trips, where the surface cars ran in connection with the terminal stations, were shortened, thereby making it possible to get many additional trips with the same equipment. The main idea is to keep up a constant feeding of the elevated trains at Dudley Street and Sullivan Square and at the same time give the outlying districts a more frequent service. The number of cars on all the other surface lines is practically unchanged. New routes have been laid out and a few of the old ones discontinued, but the changes have been comparatively small.

Charlestown Bridge.

The draw span of the Charlestown bridge is one of the most interesting structures of its class in the world. The bridge proper was finished in 1899 and was built by the city, but the elevated structure was built by the railway company.

The draw span is 240 ft.long, resting on a center pier, with a passage for vessels on each side 50 feet wide. The draw is 100 feet wide and 23 feet above mean high water. The individual trusses, of which there are four, are 24 feet deep at the end and 45 feet at the highest point of the center. The bridge provides for a double line of surface car tracks, two roadways 29 feet wide for vehicle traffic and two side paths 10 feet wide for pedestrians and a double line of elevated tracks overhead. The revolving mechanism is contained in the circular base which is 54 feet in diameter and the load is supported on solid steel wheels which are placed very close together. Two electric motors, mounted on brackets, on either side of the base, provide the power for operating the draw and are connected by suitable shafts and reducing gear to a spur wheel which meshes into a gear extending entirely around the base. Suitable hydraulic lifts at the ends of the structure serve to lock and help support the ends of the draw when closed.

Lincoln Power Station.

A new plant from which the elevated line is operated on Lincoln Wharf to which coal can be delivered direct from barges without having to pass any draw bridges. The preliminary power equipment of the station consisted of two vertical cross compound condensing engines with cylinders 44 and 88x60 inches and rated at 4,000 horse power each ; they have a maximum of about 7,000 horse power each. These machines are each direct coupled to a 500-volt direct current generator of 2,700 kw. capacity. The generators were purchased one from the General Electric Company and one from the Westinghouse Electric & Manufacturing Co.

Since the station was opened another engine of approximately the same dimensions, using superheated steam, with poppet valves on the high pressure cylinders and another Westinghouse generator have been added.

The first equipment of boilers consisted of four batteries of Babcock & Wilcox boilers, each rated at 3,800 horse power. Included in the auxiliary equipment is a Green economizer with 1,152 tubes. The condensers are of the Blake type with vertical twin pumps. Two batteries of Babcock & Wilcox boilers with acme stokers and additional economizers have since been installed.

The stack is of brick and is 260 feet in height with a 13-foot flue. Foundation and room are provided for a second stack of the same dimension. An elaborate coal storage and coal handling system was established consisting of cars and conveyors both for handling coal and ashes. Roney stokers are used.

The steel for the elevated structure was bought for the most part from the Pencoyd Steel Co., although considerable was furnished by the Carnegie Steel Co. and the Pennsylvania Steel Co. The design and erection of the elevated structure and equipment were under the direction of Mr. George A. Kimball, chief engineer of the elevated lines.

Coal Handling.

Coal for the central station is landed from barges and schooners upon a wharf just across the street from the station. Here is also landed the coal for such of the stations as are not located on the rivers or water front. An elaborate coal handling equipment is provided. This consists of a bridge crane which transports all the coal between the vessel and cars. At the water end is a cab with an 80 horse power motor for operating the ropes controlling the shovel which is of the clam-shell type, so that the coal is elevated and run out over the storage area and dumped where necessary. The storage platform is provided with two tunnels, one larger than the other. These are of wood and are of sufficient height to allow the coal cars and mining trains to back in and out. The coal is piled in heaps above these tunnels and at suitable intervals chutes and gates through the roof are provided, by the opening of which the coal falls directly into the cars.

For delivering coal to the boiler house of the central station from the dump, a distance of about 950 feet, a mining train is employed, consisting of a narrow-gage electric locomotive and two Hunt automatic side-dumping cars. The train being backed into one of the tunnels is loaded as above described and after crossing the street is run onto scales, where each car is weighed, when the train proceeds to the boiler room over a slightly elevated track, where the cars are unloaded in front of the boiler, the cars being so constructed that they dump a load without shovelling.

Harvard Power Station.

This being the last new station erected, having been completed in 1898, the nature of the power equipment is of interest. This consists of six 500 horse power Babcock & Wilcox boilers with economizers and smokestack for twice this number. At this station the boilers are fitted with "Acme" stokers, these being the only mechanical stokers used by the Boston Elevated. The main engine equipment comprises three compound Corliss engines, 28 and 56x60 inches, made by the Allis Company, direct connected to 1,200-kw. General Electric generators.

Rolling Stock.

The number of closed surface passenger cars employed by the company is 1,563 and of open cars 1,542 and box elevated cars 150. Of the former 51 are 16-ft. cars, 330 are 20-ft. cars with single trucks (including parlor cars) and 1,182 are 25-ft. cars, double trucks. The open passenger cars include 88 seven-bench single truck cars, 480 eight-bench single truck, and 747 nine-bench single truck, 46 ten-bench and 181 twelve-bench double truck cars. There are also twelve mail cars, two electric locomotives, nineteen service cars and one directors' car.

The Central Power Station.

Space will not permit of an elaborate description of the steam and electrical equipment of the various stations. The central power station, however, which is located on Albany St. and near the center of power distribution is of interest in this connection from the fact that the station and equipment have been remodeled since the plant was first established and because the equipment has recently been increased by the addition of a new unit larger, and of a different type, from those in any of the older stations and raising the capacity of the station to 18,000 h. p. This unit consists of a vertical cross-compound condensing engine of 4,000 nominal h. p. but capable of working up to 7,000 h. p. The cylinders are 42 and 90 x 60 in. and it is designed to run at 75 revolutions. The fly-wheel is 28 ft. in diameter and of the spoke type. The top of the frame stands about 34 ft. above the floor. In workmanship and design this machine sustains the reputation of both the old and new companies. The engine is direct coupled to a 2,700-kw. generator. This generator was contracted for and partly built by the Walker Co., of Cleveland, but was finished by the Westinghouse company after the latter came into possession of the plant of the Walker Co., and at that time it was the largest machine that had been designed. The total weight of the generator is about 300,000 lb., and the armature, which is 16 ft. 6 in. in diameter, weighs 115,000 lb., and is mounted on a 37-in. hollow-forged nickel steel shaft made by the Bethlehem Steel Co. The outside diameter of the commutator is 8 ft. 9 in. The field magnet frame is of cast steel and provided with hand holes. The poles are of laminated wrought iron and bolted into the frame, the handholes giving easy access to the bolts which hold the poles in place. At a normal load this generator is designed to give an output of 4,500 amperes at 600 volts, or sufficient to operate 300 loaded street cars.

The condensing "plant" of this engine is of special interest, as it dispenses with the usual air pump required with condensing engines, and forms and maintains its vacuum entirely by the use of the exhaust steam and the condensing water. The apparatus consists of two of the well-known "Bulkley" injector-condensers, attached by angle elbows to the main exhaust pipe, each condenser being 24 in. in its exhaust opening. The exhaust steam enters a hollow cone of moving water, at the upper part of the condenser, and in condensing imparts to it a velocity that enables it to carry out the air and vapor into the enlarged portion of the condenser below. The condensers are each connected with the hot-well below by air-tight water discharge pipes, of sufficient length to allow the water to be delivered by gravity against the pressure of the atmosphere. They are both supplied with water by a centrifugal pump operated by an electric motor, which takes its supply of salt water from the Bay, and after the vacuum is formed the water is elevated about 25 ft. by atmospheric pressure, thus giving the pump very little work to do. Either or both condensers may be used, according to the load on the engine and temperature of the water, and a very high vacuum is thus maintained as long as the water supply is kept up. The automatic relief valves at the top, will allow the engine to work non-condensing the instant the vacuum is lost from any cause. In many instances a natural head of water of 10 ft. or more can be obtained, in which case no pump is required, the condenser syphoning the water, after starting, and operating until the water is shut off. The safety, simplicity, and economy of this device will commend themselves to any one using a steam engine, where condensing water can be obtained. Several independent condensers may be supplied by a single pump, which may be a steam driven, a centrifugal, a rotary or other power pump.

The central power station has a very interesting history. It was designed and built in 1889-91 under the direction of Mr. F. S. Pearson, then chief engineer of the West End Co. As originally designed the equipment consisted of six triple-expansion engines belted through coun-

tershafting to multipolar 500 kw. generators. In 1896, however, under the direction of the present superintendent of power stations, the six triple-expansion engines were enlarged to 1,600 h. p. and direct coupled to G. E. generators. Two of these are of 1,350 kw. capacity and four of 1,200 kw. There are also two 2,000-h. p. engines direct coupled to generators of 1,500 kw. capacity. The fly-wheels of all the engines are of the solid plate type. This type of wheel, however, is not in favor with the engineer of the station for the reason that the attendants cannot see through so as to know the condition of the machinery on the opposite side, and they do not provide as good ventilation for the generators as spoke wheels, for the spokes set up a circulation of air that helps to cool the generators. The engines are of the Reynolds-Corliss type and were made by the E. P. Allis Co., of Milwaukee. Included in the auxiliary equipment are Stratton separators built by the Goubert Manufacturing Co., of New York, and Green economizers. The feed water is handled by a series of gang pumps of the four-plunger pattern, piped to heaters, economizers and boilers. These pumps are driven by means of a shaft actuated by a D-62 type of generator run as a motor.

In connection with the central power station should be noted the original power equipment located in neighboring building which was a part of the old Hinkley locomotive works that formerly occupied this property. This station was one of the first installed by the railway company for electrical purposes and was built in 1889, but is still running, and is used to help out the load during the heavy morning and evening traffic and in stormy weather. This station has a total capacity of 10 engines and 40 generators. The engines are tandem-compound of 200 h. p. each and are run at 210 revolutions and are each belted to four G. E. generators of the D. 62 type. It is interesting to note in this connection that no deterioration of efficiency is observed in the engines or generators notwithstanding their long service. It is not claimed, however, that the arrangement is as economical as that obtained by more modern methods.

Among the station practices, it is worthy of remark that it is the

custom of the engineer to have the different machines started up and run for an hour before the load is thrown on, thus giving the cylinders and ports a chance to warm up and prevent the danger of condensation in the cylinders, resulting in breakdowns which were so common in the early history of this equipment. In the engineer's room is found a testing equipment by which the steam and vacuum gages can be tested, the same apparatus answering for both types of gages, by the proper adjustment of the pump connections. It is the practice of the engineer to test all the gages of each machine once every month and also to indicate each engine monthly. When the station was changed, as stated above, the piping system of the whole station was also reorganized and simplified. The duplicate system of pipes was removed and by a method of coupling the same results were secured with much less complication and all this overhauling was done without interfering with the operation of the station.

The boiler equipment of the central station includes 32 boilers, all of the Babcock & Wilcox type; eight of these are double-deck batteries and 24 in single decks; two extra boilers were recently installed to provide steam for the new vertical engine. Thus far mechanical stokers have not been employed in this boiler plant.

Current Distribution.

The system of current distribution employed by the electrical engineer is one of the most interesting features of the Boston Elevated system. Early in the history of electrical railway development in Boston, it was decided, owing to the physical condition that prevailed in and about the city, that a direct current system with a number of power houses, properly distributed, was preferable in this case to a high pressure system with a single power house and transformer stations, especially as it was found possible with one exception to locate the various power stations on tide water. In order to solve the feeder problem, however, the engineer did not follow the ordinary methods of copper distribution by taking the average current consumption per car, and assuming a certain fixed drop per mile, but planned to provide for the varying loads. The load is affected by the speed of the cars in congested localities when the cars are off schedule time, and varies greatly because of the snow plow operation in winter; the maximum demand during the summer months had also to be considered. The average consumption of power was found by dividing the total output of the stations by the number of cars on the line at any one time. The result, however, was modified in many cases by the actual feeder readings which were taken on days of excessive load at all the power stations between 4 and 6 o'clock p. m., the hours of maximum travel, from which the capacity load of each section was obtained. As a basis for the work, a map is prepared each year, showing all the lines operated, together with the location of each power station, car house, and the boundaries of the various sections into which the territory is divided. The position of every car at the

time of maximum load is based on the regular time table schedule. The cars are indicated by cross lines, each cross line representing two cars. The territory is divided into 56 sections. These sections are so coupled that any one can be cut off in case of trouble and sections can be coupled together to help out during hours of heavy traffic. In arranging the size of the section, care was exercised to make them small enough to be safe and large enough for economical operation, so each was made to meet the local condition. In computing the copper required to give the most economical results, the engineer followed a method devised by himself.

In the central power station the feeder panels and tables are grouped at one end of the switchboard gallery and the ground feeders are connected in on the opposite side of the same bus bars as the negative leads from the generator, an arrangement which saves copper. The feeders lead beneath the floor of the gallery and into the basement, where they separate into four divisions or groups. Group 1, going west, consists of 20 overhead feeders; group 2, of 20 underground cables and 90 buried ground or return wires; group 3, going east, 15 overhead feeders and 4 overhead returns, and group 4 of 25 underground cables and 8 buried grounds.

The lines are all operated by the overhead system, except on the elevated structure. The feeders in the business district are carried underground, as also a few in the outlying district. In other cases they are carried overhead.

The overhead feeders consist principally of 500,000-c. m. cables; some, however, are 300,000-c. m. and a few 1,000,000-c. m. For the small feeders No. 0000 and No. 0 wire are used. The insulation of the overhead feeders is of tarred jute principally, and they are supported on glass insulators of the petticoat pattern. The underground feeders are insulated with paper or rubber, according to the conditions likely to be encountered in the soil. The resistance of the insulation on the underground cables ranges from 200 to 1,500 meghoms per

mile. It is the practice to test the different cables at the station every two or three days, in order to detect incipient defects, so that they may be remedied before developing into serious trouble. The drop in potential varies on the lines from 10 to 15 per cent., except on one or two of the longer lines, where the drop reaches 20 per cent. In ordering cables or wires the specifications as to purity are that the resistance shall not exceed .1157 ohms per mile of 500,000-c. m. section.

The total length of the overhead feeders is 456.5 miles, of which 13 miles are returns. The aggregate of the underground feeders is 63 miles, and of the returns 68 miles. There are also nearly three miles of armored submarine cables for use under the draw or swingbridges, of which there are 25 on the system.

The underground conduits have been constructed both of terra cotta ducts laid in cement and of cement lined iron tubes. The manholes are from 50 to 400 ft. apart, and are in general located at street corners. In moist ground the manholes are built with double walls with water proof paper between. About 11 miles of underground conduits have been constructed, containing 133 miles of individual ducts. In some cases the return consists of scrap cable, from which the covering has been removed, the bare wires being drawn into the duct. In some cases as many as five wires have been placed in a single duct. Scrap trolley and feed wire is also used for bridging around special work; also for laying across bridges where flat rails are used, and also for cross connections from track to track.

Besides the general map showing the entire feeder system, the electrical engineer prepares, from time to time, blue prints of the individual sections showing the location of all the feeders, overhead, underground or submarine, also the location of switch boxes and cutouts, with the sizes and numbers. These diagrams are supplied as changes occur, to the crews of each of the eight emergency stations, and also to each division superintendent and to each of the general officers. These are designed to assist the crews of the emergency stations in making repairs to overhead

lines and feeders and to enable them to make temporary changes in the feeder switches, as may be directed by the operating department.

The emergency stations are all equipped with all the usual appliances, including tower wagon, tools and teams, and the crews are on duty at all hours. Among the appliances not usually used with wagons of this nature was noted a low two-wheeled truck or dinky, which is carried on some of the emergency wagons, and is designed for removing from the tracks heavy trucks or wagons that may become disabled by the breaking of a wheel or axle. The tower wagons are mostly of the Trenton type. The stations are all connected with the public telephone service, and also by private telephone line and exchanges, to all the power stations, car houses, and with the offices of the company. The crews respond to all fire alarms in their respective districts, and when necessary remove overhead wires and feeders and afterward restore them to their proper positions.

Repair Shops.

The repair shops of the entire system occupy two sets of buildings, one on Albany street, near the central power station which was formerly occupied by the Hinkley Locomotive Works, the other on Bartlett street, near Washington, and several miles from the former. The Albany street buildings also provide for the storing of supplies. A new shop is contemplated by the management, so that all the repairing can be done under one roof. The first floor of the Albany street shop is known as the car equipment shop, where motors are mounted, trucks repaired and car bodies adjusted to the truck. On this floor are a number of heavy iron working machines together with the wheel borers and the wheel presses. The tools are operated by a stationary motor, and special motors are provided for some of the larger tools. This shop is provided with pits, also with trucks and hand hoists and pneumatic hoists for the handling of heavy parts. One section of the blacksmith's shop also occupies this floor. The different floors of the building are served by an elevator, and material is lifted to the different floors on small trucks, which run on tracks through the different departments. The first floor also contains the motor testing department.

The machine shop proper, which is under the supervision of Mr. John L. Mitchell, occupies the third floor and the equipment of tools is very complete. Trolley wheels, car trimmings and brass fittings of every description are made in the shops, a brass foundry being provided for the castings. Among the special methods and practices of the shop may be noted a device for turning trolley wheels. This is so designed that the wheel is mounted on a mandrel and a cutting tool

of the desired shape for the groove is brought into action and turns each wheel to an exact pattern at one operation. The cutting tool is made of steel like a small sheave, but with a segment cut out making the cross section of the rim of the desired form of the groove. To sharpen this tool one side of the segment is ground flat, a very simple operation, and each grinding leaves the cutting edges of the same shape. A single cutter of this design is said to last for the turning of as many as 50,000 wheels. In fact, it is almost indestructible. The work of turning the wheels can be done by a boy, as very little skill is required, and one is able to turn up as many as 300 wheels a day. For forming the outside edges of the flange of the wheel a cutting tool is mounted on the same head, and is brought into action as required.

Among other interesting machines are two Hartness flat turret lathes made by the Jones & Lamson Machine Co., Springfield, Vt., which are used for making the steel bond thimbles, by means of which the rail bonds used on this system are attached to the rail. The largest of these are taper plugs about 2 inches long, bored out to receive the bond wire; these being swedged to the bond and driven into the rail holes, make good electrical contact. This machine receives a steel rod of proper size and turns out complete thimbles.

In one section is a machine for testing the ability of trolley wire to stand the bending strains. A section of trolley wire about a foot long is fastened to an ear or clamp in the ordinary manner, and this is held stationary, while a rod attached to the crank of a wheel is fastened to the other end, so that the wire is bent up and down through about the range that is found in actual service. This machine has a register which counts the number of times the wire is bent, and the machine is run at about 60 revolutions per minute. A record is made of how many bends the wires of different sizes will stand before breaking.

The tool room is fenced off in one section of the floor in which tools are kept and repaired and dealt out to the workmen.

Several of the best machinists are assigned to night work in the shop. These are always on duty at night, so that they may be on hand for any special repairs that may be required. A list of 15 or 20 of the regular machinists is also kept, with their house address and nearest telephone station, so that in case of breakdowns, or when their services are required at night, the master mechanic can call on one or all of them and order them out for any special work.

The armature repair department occupies a floor of this same building, and here all repairs to armatures, commutators, rheostats and controllers are made. Commutators are made in the shop from drop forged bars, which are purchased from the dealers. Female help help is employed in the coil winding and taping department. For taping the coils, stands are provided with a swinging button, so that the coil is held firmly in position to facilitate the winding. The tape is wound on circular bobbins having a tension apparatus, so that the roll is passed readily through the coil, and the winding quickly effected. Only plain tape is employed for winding the coils, but after winding, the coils are dipped in an insulating compound known as "Armalac." In the opinion of the shop superintendent, this method is superior to that formerly employed, as it gives the best insulating quality, remains flexible, and is cheaper than paper or rubber insulation.

The brass foundry occupies a portion of the ground floor and here seven molders are usually employed, for, as noted above, all the trimmings, as well as trolley wheels and other brass supplies, are cast in this department. Scrap copper is used, while the tin and spelter are purchased in the pig. The equipment of this foundry includes six brass furnaces, with all the auxiliary equipment usually found in foundries of this character. Car trimmings not only for repairs are made, but all the trimmings for the new open cars that are built are here cast and finished up in the machine shops. The car trimmings include the out rigged double handles.

A full description of the car repair shop will not be attempted, as

the general details are much the same as prevail in the shops of other large systems, and only a few tools and methods will be mentioned. The machine tool equipment for the wood shop is very complete, and among the recent additions is a surface sanding machine that is considered by the shop superintendent as a very valuable tool.

It is the practice of the company to make the cushions and backs for upholstering the car seats, the seats being all of the longitudinal type. This department is partitioned off from the main shop, and is equipped with sewing machines and other appliances for cutting and uniting the materials and also for preparing the curled hair. All the car seats are upholstered in plush, and for this purpose the material, in a combination of red and black colors, is bought in quantities, and this, as well as the curled hair, is the best quality.

Among the labor saving devices, found in an adjoining department, is an arrangement for cutting glass, on which the faces for the stationary headlights are cut out in circular form. The headlight disks are about 9 inches in diameter, and are cut out from square panes of glass at the rate of three a minute. This is accomplished by placing from 25 to 30 plates of glass in a pile on a pivoted table, so that the pile can be readily turned by a handle attached to the table. Above this is a vertical rod having on its lower end a wooden disk of the diameter to which the glass is to be cut. The rod, by means of a short lever and rope, is made to bring the disk down upon the top layer of glass with sufficient pressure to keep the pile in position. A diamond glass cutter is then placed against one side of the disk, and the table being revolved a circular cut is made in the upper layer of glass. The disk is then lifted, the top glass taken out, placed to one side, and the process is repeated till each layer of glass has been cut. After this the different panes of glass are gently tapped against a plug located over a hole in the table, and the outside rim breaks away in pieces, the pieces falling into a barrel placed underneath the table, and the completed disks, all of the same diameter, are ready for the lamps.

The saving of scrap paint is quite a feature in these shops. The inner surfaces of barrels, kegs and cans, in which paint is received, are carefully scraped after being emptied. These paint skins, together with the paint soaked out of the brushes, are cooked in a jacketed steam boiler; then all the paint and oil is skimmed off and this material is then properly mixed and used for painting trucks and floors of buildings.

One of the types of car motors used has to be housed in with wood or canvas to protect it from dirt and moisture, and another labor saving device is noted in the means used for painting the strips of canvas from which these motor screens or coverings are cut. The water proof paint for this purpose, on being mixed, is put into a wooden box with slanting sides, and to one side is fastened a set of large tinners' rolls, borrowed from the tin shop, and used as is a clothes wringer. The rolls of canvas, which are purchased in 100-yard lengths and 28 inches wide, are mounted to one side of this box when the end is dipped into the paint and led out through the rolls. An attendant then takes hold of the end of the strip and pulls it through the rolls as fast as he can walk. After all is run through, it is left lying on the shop floor till the paint is partially dry, when it is hung in a suitable place for further drying.

Open cars are run through the shops for cleaning and painting in the winter season at the rate of about 60 a week. The old paint and varnish is burnt off; this process is considered by the shop superintendent better than the use of any of the liquid compounds which are recommended for removing paint, for the reason that by the burning process no acid is left to affect the wood. The open cars are numbered on the bumpers.

A room with fire proof walls is set apart for the storing of paint, oil and varnish, and this is provided with steam pipes and boilers and other accessories usually found in a paint department of this charac-

ter. Paints are dealt out only on orders from the foremen of the different departments.

The buffing department is run in connection with the shop for the purpose of finishing and cleaning the brass car trimmings, all of which are cast in the company's foundry as before mentioned.

The stock room adjoins the superintendent's office, and occupies a part of two floors. All supplies are issued to the men on an order from the shop foreman, and are charged to the particular car or job. The shops employ ordinarily in winter 225 hands, but more in summer. Each man is provided with a daily time slip, which he fills out in his own handwriting, giving his name, residence and the department in which he works. He records the time he spends on any job, and the men are checked in and out of the shop both morning and afternoon. The time slips are copied in the office and are kept on record. In conducting the office work a library card system is provided, both for the records of the men and for each car or job. Suitable cabinets are provided for the cards, and the work is so systematized that with comparatively little labor the cost of all work is accurately recorded.

Headquarters.

The executive offices of the company and of most of the departments occupy eight floors of a large building at 101 Milk St. The space includes the drafting room for both the elevated lines and for the civil engineer's department of the surface line. Each floor is cut up into offices suitable to the requirements of the different departments and all are supplied with the latest designs of office furniture, and are as completely organized as the latest office practice can suggest. Three of the departments have headquarters in other buildings. On the roof of this building, two blue print rooms have been constructed of sheet metal, one for the engineering department of the elevated lines and the other for the civil engineer's department of surface lines.

The equipment of these rooms is very complete and the glass with its frame and table is mounted on a truck by means of which it is run out or in over a suitable track. The layout of rooms also includes a small tool room, a track museum for samples of rail and track equipment and a store room for telephone supplies and tools.

A private telephone exchange is maintained in the building which connects all the offices, not only those in the building, but the car houses and car stations of the whole system.

Organization and Regulation of Departments for Surface Lines.

The system of the Boston Elevated Railway Co. is the fourth largest under one management in the country. The length of the surface lines aggregate, including car houses, 416 miles, all of which is operated by electric power, and for generating the current, seven power houses have been erected with a total capacity of 36,944 kw.

The number of employes ordinarily on the pay rolls is 7,200. The number of closed surface passenger cars is 1,512, and of open cars, 1,542. The number of passengers as reported for the last fiscal year was nearly 340,000,000, of which 222,484,811 were revenue passengers. The earnings from cars were $11,088,494.93.

In order to operate a property of such vast magnitude economically and satisfactorily, to both the patrons and the investors, it is evident that a complete organization of the forces and a wise system of discipline must be primary requirements and that each must be done to a scientific nicety. That the responsible parties have mastered the situation admirably so as to meet the many difficult problems, due both to the geographical situation and public demands is evident to one who will inform himself and compare the work with that which prevails in other cities. If there is one thing more than another to be quoted in evidence of the wisdom of the plans followed it is that of the universal harmony and good-will that is apparent among the heads of the different departments in their relations to each other.

The Executive Committee.

All large matters, and many small ones, arising in the management of the Boston Elevated Railway Co. are determined by a committee of the Board of Directors, subject to the approval of the full board. At present this committee consists of the president and two other directors. These men are in the prime of manhood, and their accomplishment speaks louder than words of their breadth of conception and skillful execution in the work they set out to perform. The "L" was built and both elevated and surface lines are operated under the general guidance of the executive committee, which consists of Major General Wm. A. Brancroft, the president of the company, who is chairman of the committee, Robert Winsor and James M. Prendergast, with John T. Burnett, secretary of the committee.

Vice-President Charles S. Sergeant has general supervision of the operation of the entire system of the company, but the immediate operat, ing head of the Elevated division is Superintendent Herbert A. Pashowhile the various surface divisions are also looked after by nine superintendents.

Maj. Gen. WILLIAM A. BANCROFT,
President of the Boston Elevated Railway Company.

The Boston Elevated Railway Company, one of the four largest street railway systems in the world, operating over three thousand cars and giving employment to over seven thousand men, has as its head one of the most popular street railway men of the country, Maj.-Gen. William A. Brancroft, whose career in political, military and business affairs is well known. He was born at Groton, Mass., April 26, 1855, son of Charles and Lydia Emeline (Spaulding) Bancroft. His ancestors on both sides settled in Massachusetts about 1640. He was educated in the public schools and at the Lawrence Academy in his native town. He was graduated at Phillips Exeter Academy in 1874, and at Harvard College in 1878. He studied at the Harvard Law School, and was admitted to the Suffolk bar in 1881, and settled at Cambridge, Mass. While in college he was captain and stroke oarsman of the famous Harvard university crews that so signally defeated Yale at New London, in 1877, '78 and '79. Joining the militia as a private when a college freshman, in 1875, he passed through the various grades, becoming captain of his Company (B) in 1879, and colonel of his regiment (the Fifth) in 1882. Under his command the regiment increased in efficiency, and in 1889, because of its military excellence, it was detailed as an escort to the Massachusetts delegation at the centennial celebration of the inauguration of Washington at New York.

Colonel Bancroft became the senior colonel of the Massachusetts Militia, and as such commanded the Second Brigade at the mobilization of all the state troops in Boston in 1895.

In July, 1897, he was unanimously elected brigadier general of the Second Brigade, and in May, 1898, he was appointed by President McKinley brigadier general of the United States Volunteers, and was assigned to the command of the Second Brigade of the Second Division of the Seventh Army Corps, with which he remained until the cessation of

hostilities, when he resigned, and was honorably discharged the last of August. He remained in the militia, and on January 4, 1901, was placed on the retired list with the rank of major-general, but remains as president of the officers' examining board. He was grand marshal of the veterans' column in the great military parade on the occasion of the unveiling of the Hooker monument in Boston, June 26 of the present year.

In 1885 he left the practice of law to become superintendent of the Cambridge Street Railway Company, and afterwards was General Roadmaster of the West End Street Railway Company, with its 240 miles of track. While superintendent of the Cambridge Railroad, not only was his management financially successful, but in 1887, when all but thirty of the six hundred and fifty employes went out on strike, such was his firmness, energy and organizing ability that in a short time all of the company's twenty-two lines were in full operation. In spite of his determined conduct the strikers admitted his fairness, and accorded him their respect. General Bancroft left the street railway business in 1890 and returned to the practice of law.

In the spring of 1896, he became counsel for the Boston Elevated Railway Company, and in the following year was chosen a Director and Vice-President, becoming chairman of the Executive Committee of the Board of Directors. In 1899 he was elected President of the Company.

In 1882 he was elected to the common council of Cambridge. In the fall of that year he was elected a representative to the legislature and was twice re-elected, serving during the years 1883, '84 and '85. In 1890 he was elected to the Board of Aldermen, and was re-elected the following year, being made President of the Board for both terms. In 1892 he was elected Mayor of Cambridge, and was three times re-elected. His administration was characterized by economy and progress. General Bancroft is a Republican in politics, though national party lines are not recognized in Cambridge municipal elections, and at this time the city was Democratic by a large majority. He presided at the state convention of his party in 1893. In the same year he was chosen by the Alumni of

Harvard College a member of the Board of Overseers, and was re-elected in 1899 for another term of six years. He was chief marshal of the Commencement Day procession at Harvard this year. In 1894 he was elected President of the New England Alumni of the Phillips Exeter Academy, and was re-elected for the three succeeding years. He was chosen to preside at the Alumni dinner last June on the occasion of the 120th anniversary of the founding of the Academy.

He has also been president of the Cambridge Club, president of the Mayors' Club of Massachusetts, is a trustee of the Lawrence Academy, a director in the United States Trust Company, Boston, trustee of the Norwich University of Vermont, member of the Naval and Military Order of the Spanish American War, Massachusetts Commander of the Military Order of Foreign Wars, a member of the Society of the Cincinnati, and a member of various social clubs. General Bancroft is a forcible speaker and possesses great executive ability. He was married in 1878 to Mary Shaw, of Peabody, and has two sons and one daughter.

CHARLES S. SERGEANT, Vice-President.

Mr. Charles S. Sergeant, Vice-President of the Boston Elevated Railway Company, was born in Northampton, Mass., in 1852, the son of George and Lydia (Clark) Sergeant. His father was born in Stockbridge, Mass., which has been the family home since the settlement there in 1735 of his great-great-grandfather as a missionary to the Stockbridge Indians.

He was educated in the public schools of Northampton and graduated from the High School in 1868. In that year he began his business career in the employment of the First National Bank of Easthampton. In 1872 he entered the steam railroad business as paymaster and cashier of the Marquette, Houghton & Ontonagon Railroad Company, and was also associated with various iron companies and engaged in the iron smelting business.

In 1876 he came to Boston to take the position of chief clerk of the Eastern Railroad Company, subsequently being appointed general auditor. In December, 1887, when the West End Street Railway Company came into possession of the several street railways centering in Boston he was offered and accepted the position of general auditor of the company, subsequently being made second vice-president, and in November, 1892, being appointed general manager, which position he held until the lease to the Boston Elevated Railway Company.

JOHN T. BURNETT, Secretary.

John T. Burnett, Secretary of the company, is an official of rare ability and peculiar adaption to his position. He has the confidence and esteem of every one connected with the various departments of the road. Prior to his connection with the company, Mr. Burnett was assistant postmaster of Boston under the late Cleveland administration, and upon the death of Col. Coveny acted as postmaster until the appointment of the late Henry A. Thomas to that position.

WILLIAM HOOPER, Treasurer.

William Hooper, Treasurer of the Boston Elevated Railway Company, was born in Boston in 1855, and graduated from Harvard in 1880. For several years he was with the Amoskeag Manufacturing Company, and later with the Pacific mills. He was treasurer of the Atlantic cotton mills and auditor of the Calumet & Hecla Mining Company. He assumed his present position early in 1898. From 1893 to 1898 Mr. Hooper was a director and member of the executive committee of the West End Street Railway Company.

H. L. WILSON, Auditor.

H. L. Wilson, Auditor of the Boston Elevated Railway Company and president of the Street Railway Accountants' Association, was born in Boston in 1862 and received his education in the public schools of that city. From the time he was 16 years old until 1887 he was connected with several mercantile and importing houses. His progress in the business world was not such as to satisfy the young man, so he concluded to seek his fortune in the west. Accordingly he went to Kansas City and joined the auditor's force in the office of the Metropolitan Street Railway Company, where he obtained his first experience in railway accounting. In 1888 Mr. Wilson was offered and accepted the position of head of one of the departments in the auditor's office of the West End Street Railway Company of Boston, and in 1891 he was elected auditor, which position he held until the lease to the Boston Elevated, when he became auditor of this company.

HERBERT A. PASHO,

Superintendent of the "L" Division.

Mr. Herbert A. Pasho, superintendent of the "L" division, with headquarters at the Sullivan Square terminal, Charlestown, was born May 24, 1859, at Billerica, Mass. His early education was gotten in the village schools until at the age of twelve he was obliged to leave school and go to work. At the age of fifteen his mother died, so that the responsibility for his brothers and sisters rested largely upon the shoulders of the man who in later years was to have the transportation of such vast numbers of people under his charge. By hard work and perseverance Mr. Pasho, at the age of seventeen, managed to take a course in the Lowell Commercial College, after which he engaged in farming. He later accepted a position as foreman on the farm of United States Senator Rollins, of Rollinsford, N. H.. and continued in that capacity until a desire for a change prompted him to come to Boston, where he hired out with the old Cambridge road as conductor in December, 1885, being engaged by the present President of the Boston Elevated Railway Company, General Wm. A. Bancroft, at that time superintendent of the horse railroad. Mr. Pasho remained a conductor until July, 1889, when he was appointed starter at the Arlington station. The following November he was promoted to the position of foreman of the North Cambridge station, where he had charge of about 100 motormen and conductors and also a stable of sixty horses, which were used on the Beacon street, Somerville, line, which runs from North Cambridge. As foreman of the North Cambridge station Mr. Pasho gave very good satisfaction and in June, 1891, was made superintendent of the Ninth Division, comprising Brighton, Brookline, Newton, etc. Still there was more in

store for him, and accordingly in December, 1898, he was appointed superintendent of the largest surface division on the system, known as the seventh division, comprising Cambridge, Somerville, Arlington, Watertown, Waverly and a part of Newton and Medford. Mr. Pasho had charge of about 1,500 men, over 100 miles of track, and operated about 400 closed and 380 open cars. Here, too, he repeated his former successes, which the management recognized by appointing him Superintendent of the "L" division on November 1, 1901.

GEORGE A. KIMBALL,

Chief Engineer Boston Elevated Railway Company's "L" Lines.

Mr. George A. Kimball is the engineer of the "L" lines.

All the plans for the elevated structure, stations, etc., were made under his direction, and he personally superintended nearly all of the construction. Mr. Kimball was employed by the Boston Elevated Railway Company in August, 1896, in connection with the preliminary surveys, and in 1898 was appointed chief engineer of the elevated lines. Some idea of the work of his office may be obtained from the statement that he had 150 persons employed in the engineering department, while 2,000 men at a time were engaged in the work of construction.

Mr. Kimball had a varied experience, both as a public official and as an engineer. He was born in Littleton, Mass., May 14, 1850, and was the son of William and Mary A. (Lawrence) Kimball. His boyhood education was obtained in the public schools of Littleton.

Later he attended Appleton academy at New Ipswich, N. H. He commenced business as an apprentice with Frost Brothers, civil engineers. He went to Somerville in 1869. In 1870 he carried the rod and chain in making surveys for street and sewer improvements in Somerville, and the following year continued in the same line, with the addition of preliminary railroad surveys for the Massachusetts Central railroad, the Brighton & Newton railroad, and a branch of the Old Colony railroad in Scituate and adjoining towns. In 1872 he was partner with Frost Brothers. The next year he began business for himself, and for three years engaged in the general practice of his profession. During this time he was connected with the Millers' river improvements, the Arlington waterworks, and other miscellaneous surveys. In 1876 Mr. Kimball was appointed city engineer in Somerville and continued in that office until April, 1887, when he resigned and took up a general engineering business.

In 1888 he was appointed by Governor Ames a member of the grade crossing commission, called the "original" commission, which investigated and reported to the legislature in regard to the abolition of all grade crossings in the state. Afterward he was consulting engineer for Brockton, New Bedford, Haverhill and Lynn on the question of abolishing grade crossings. He was consulting engineer on sewerage questions for Montpelier, Milton, Salem and Peabody, and he built the sewer system in Arlington and the water works at Millis.

He was a member of the Somerville board of aldermen in 1889 and 1890. He was appointed consulting engineer for the city of Somerville for the year 1896. In November, 1896, he was appointed a member of the Metropolitan sewerage commission, and continued in that position until the consolidation with the Metropolitan water commission. Since, he has been connected with the Boston Elevated Railway Co. He has devoted considerable time to the study of transportation problems and for that purpose has examined the principal street railway systems of this country and of Europe.

He was married February 29, 1872, to Miss Lizzie Emily Robbins. They have four children.

CHARLES F. BAKER,

Supt. of Motive Power and Machinery.

Charles F. Baker, Superintendent of Motive Power and Machinery, was born in Shoreham, Vt., in January, 1855. The family moved to Wisconsin when he was small, and young Baker secured a position in Milwaukee, where he learned the trade of an engineer. He has since had a varied experience as a mechanic and engineer, and has held many important positions. He is well known among the street railway companies of the country and to manufacturing corporations as well.

In the year 1893 he came into the employ of the West End Street Railway Co. of Boston, serving as master mechanic. Under his direction and supervision four of the power stations of that company, those at Dorchester, East Boston, Charlestown and Harvard street, were built and equipped. The extension of the company's lines demanded the entire remodelling and enlargement of the central power station of the West End Street Railway Co., and some notable improvements, among which is an improved system of handling coal in the station, were introduced under his direction. When the Boston Elevated Railway Co. secured its lease of the property of the West End Street Railway Co., Mr. Baker went with the new corporation to take his present position.

JULIUS E. RUGG,

Supt. of Transportation.

Julius E. Rugg, Superintendent of Transportation, comes from sterling old New Hampshire stock, being the son of Capt. William S. Rugg of Rindge, N. H. At eighteen years of age he became a country school teacher, like many other New Hampshire men who have risen to positions of trust. Coming to Boston four years later, he became a conductor on the Chelsea and Boston cars, and after a year's faithful service was put in as receiver in the street railroad office in Chelsea square, where he remained for three years, leaving the position to become superintendent of the Lynn & Boston Railroad. After four years with this corporation he left to become superintendent of the Highland Street Railway Co. in Roxbury, where he remained for fourteen years in charge of what was known at that time as the most progressive street railway in the country. Upon the organization of the Boston Consolidated Street Railway he became its general superintendent, holding the position two years. Mr. Rugg then went to Minneapolis as general manager of the Minneapolis Street Railway Co., but after a year in the west he received a call, as the ministers say, to become general manager of the Citizens Traction Co. of Pittsburg. After serving that corporation with credit for seven years, he returned to the scene of his first successes, and became general superindent of the West End Street Railway Co. After two years the lease of the West End Co. to the Boston Elevated Railway put him in his present position.

Always striving to be not only up-to-date, but looking ahead and keeping in touch with all improvements in street railway work and methods, he has introduced many valuable improvements in the street railways with which he has been connected. He introduced snow scrapers on cars and double-end snow plows while superintendent of

of the Lynn & Boston Railroad. In the Highland Street Railway superintendency he introduced cross-seat open cars, improved high-wheel snow plows, cased windows in box cars in cold weather and other devices for the comfort of the passengers and to attract traffic. He was the first to put uniforms on conductors and drivers, in 1872, and first made use of a cash register in Boston, in 1876. Under his charge the Citizens Traction Co. was made a model cable road in its organization and operation. Believing in co-operation with employes, he organized the first Relief Association for street railway employes in Boston on the old Highland Street Railway, and also organized an association of the same kind in Pittsburg. Respected and liked by his superiors and by the men in his charge, he has become widely known as a successful and able street railway man.

DANIEL L. PRENDERGAST.

Real Estate Agent for the Boston Elevated Railway.

Mr. Daniel L. Prendergast, real estate agent for the Boston Elevated Railway, was born in Boston in 1857, and graduated from the Bigelow school, and later from the English high school. His first employment was in the Boston office of the treasurer of the Hamilton and Appleton Companies of Lowell, where he rose to the position of transfer and corporation clerk of the Appleton Co. In 1898 Mr. Prendergast became associated with the Boston Elevated Railway Company as real estate agent, and today he looks after millions of dollars' worth of property. Mr. Prendergast has for years been one of the most fervent friends that the Carney Hospital has ever had. He has been D. D. S. K. of the Knights of Columbus; was for two years Grand Knight of Beacon and James E. Hayes Council, Knights of Columbus; was for two years president of his class association; has for many years been a member of the executive committee of the Young Men's Democratic Club; has been a member of the Clover Club since its organization; vice-president of the Bigelow School Alumni Association; and is a member of the Charitable Irish Society, the Beacon Association, Exchange Club and Winthrop Yacht Club. In 1880 Mr. Prendergast was married to Miss Susan M. Maley, a daughter of one of the most highly respected citizens of Boston, and two children, a son and daughter, have blessed their union.

THE FIRST DIVISION.

Joseph W. Moore, superintendent of division 1, Boston Elevated Railway, with headquarters at Grove Hall, Dorchester, has seen over thirty years of street railway service, and has been superintendent of the of the oldest division of the system for about fourteen years. Mr. Moore was born in Quincy, Mass., December 21, 1845, his father being Alexis W. Moore, a prosperous farmer of that town. He attended the local schools and remained on the farm until 22 years of age. In 1867 he secured a position as conductor on the Quincy horse railroad, and remained there until the road was discontinued in 1871. The Quincy road opened for business in 1865, the tracks extending from Penn's Hill in Quincy, to State and Broad streets in Boston. The fare was 25 cents from Quincy to Boston, and four trips were made daily of the eight cars in use. Each man was obliged to work 16 hours each day and they received $45 a month. In the trip from Quincy to Boston horses were changed at two different points, Wollaston and Field's Corner. John J. Glover was president of the road, while Charles Cook was superintendent. The road ceased to exist in 1871, and the tracks were soon after taken up. In April, 1872, he commenced work with the Highland street railway company, Moody Merrill being president, and J. E. Rugg superintendent. He took fares on cars running from Grove Hall to Boston for about six months, and was then given the position of Starter and Check Agent at Dudley street office, and remained there until the Columbus avenue line was started in 1878, when he was put on the street in Boston as Aid, and filled that position until 1885, when the consolidation of the Middlesex and Highland roads took place. Mr. Moore was then transferred to the Charlestown division, to take charge of the operating of cars, under the direction of Mr. Rugg; Mr. John H. Studley was superintendent. In 1887 Mr. Moore was appointed Superintendent of the first electric division operated in Boston, with headquarters at Allston, Mr. Henry M. Whitney being president of

the West End. Mr. Moore was superintendent of the ninth division. He was there during the erection of the power house, during which time Mr. B. F. Longstreet was general manager of the system. Mr. Moore broke in the men to run the first electric cars, there being seven or eight cars on the road when it finally got into operation. In 1889 he was transferred to division one, as superintendent, Mr. F. H. Monks being the general manager of the West End. At that time the division had about 2,000 horses. In 1891 the whole system was equipped with electricity, and at first started twelve cars out of the Grove Hall station. At the present time there are about 350 cars in the first division, while that number of regular crews of conductors and motormen are employed. The division has over 70 miles of track in the streets, and has seven inspectors, 27 starters and check men, while a large number of track men are given employment. There are 3 stations in the division, Grove Hall, Forest Hills, and Dorchester. There are many men in the division that have seen from 3 to 35 and 40 years' service in the street car business.

Mr. Moore married Clementina Holmes of Chelsea, in 1875.

THE SECOND DIVISION.

The oldest superintendent in years of service of the Boston Elevated Railway Company is Joseph M. Gould, who has seen thirty-three years of street railway service; he was appointed Superintendent of the Second Division of the Metropolitan Street Railway Company in 1886, and has since that time most ably filled the position. Mr. Gould was born in Belfast, Me., April 16, 1844, his father being a local merchant. At the death of his father in 1865, he came to Boston, and secured work in a box factory in South Boston. After closing his labors at wooden box making, he worked in a grocery store for a short time, and 1870 hired out as driver for the South Boston Street Railway, under Superintendent Robert Johnson. The cars ran from South Boston to Scollay Square, and after a time he secured a similar position with the Metropolitan Street Railway Company, under Superintendent William Hendry. For two years he worked on the system, the line running from Dorchester, Roxbury Crossing, Jamaica Plain and Brookline to the Tremont House in Boston. It took two hours to make the trip, the cars running on twenty-minute time.

Mr. Gould then went to New York, and continued railroading, being in employ of the Third Avenue line, under Superintendent Dickinson. He drove from Harlem to what is now Herald Square, and after remaining there a year and a half, he returned to Boston and again took up his labors with the Metropolitan. After being on the front platform for about five years, he was given the other end of the car and served as conductor for about five years. Mr. Gould was then given the position as starter, with his post of duty at the corner of Washington and Northampton streets. In February, 1886, Mr. Gould was appointed Superintendent of the Second Division of the Metropolitan, under President Calvin Richards. When the Metropolitan was merged into the West End Street Railway Company, he

remained as Superintendent of the same division, Henry M. Whitney then being president of the company. And again, when the Boston Elevated Railway Company came to the front, he was continued in service as Superintendent of the division that has maintained its personnel from the start. Mr. Gould has served under five presidents of the Boston street railways : Calvin Richards of the Metropolitan ; Henry M. Whitney and Samuel Little of the West End, and Col. William A. Gaston and Gen. William A. Bancroft of the Boston Elevated. The second division operates 215 cars, 700 conductors and motormen are employed, as well as about 150 men in the road department. The division has a trackage of about sixty miles.

THE THIRD DIVISION.

Mr. Frank I. Wilkins, Superintendent of the Third Division of the Boston Elevated Railway, with headquarters in Dorchester, has been in charge of that division since November, 1901. Mr. Wilkins was born in Salem, Mass., in 1862, attended the local schools and commenced railroading in 1888, first as conductor on the Charlestown division of the West End Street Railway, Mr. John H. Studley being superintendent at that time. He took fares for two years, then went to Division Eight, under Superintendent Clark, as extra starter, working for one summer at Rowe's Wharf, which in those days was a very busy spot. In the fall of that year he was transferred to Park Square as starter. This was the time of the operation of the "tow cars," the terminal of the lines being at the corner of Charles and Boylston streets. In the fall of 1891 he was appointed starter, with headquarters at the old Tremont House, which will be remembered as a very important point. He was there two years, and then went to the main office, 81 Milk street, as clerk in the time table department. After two years' service there he was appointed chief clerk of Division Eight, under Superintendent Hawes. He was there nearly six years, and was promoted to the position of superintendent of the Third Division in November, 1901. The Third Division has 53 miles of track, 299 box and open cars being used, and 450 men are given employment. There are three car houses, located at Field's Corner, Milton and Neponset. The cars of the division run to Divisions One, Two, Five and Eight.

One of the most vivid experiences of Mr. Wilkins' street railway career was during the storm when the steamer Portland was lost. Mr. Wilkins was chief clerk in Superintendent Hawes' office at the time, and for several days following the great fall of snow his duties called him to the telephone to such an extent in holding the receiver to his ear it caused him to partially lose the use of three of his fingers for several months, their normal condition being restored by the constant use of electricity.

THE FOURTH DIVISION.

The Fourth Division of the Boston Elevated Railway has most of its trackage in East Boston, which necessarily makes it a small division, yet the business done on the 14 miles of track is hardly exceeded by any road of equal miles of track in the country. The 125 conductors and motormen keep the 32 box or open cars in constant operation, the traffic being very heavy during nearly all hours of the day and late into the night to the ferries and steam road. Mr. H. H. Esty, superintendent of the Fourth Division, is 57 years old and was born in Groton, N. H. When he was two years old his parents took up their residence in Lyme, N. H., where the subject of this sketch received his education, graduating from the high school in that town. After he left school he enlisted in the 18th N. H. regiment when the Civil War broke out. He was stationed in front of Petersburg most of the time, being there at the time of the evacuation of Petersburg and Richmond. His war record is a creditable one. At the expiration of hostilities Mr. Esty returned north, but soon after went west and secured a position as brakeman on the Milwaukee & St. Paul Railroad. After remaining there one year he returned east and went into the harness business in Manchester, N. H. He was there 15 years and came to Boston in 1878, when he started his career as a street railway man, by taking fares on the old Metropolitan road. After a year's service he was put in charge of the harness shop of the railway, having supervision of all harness and horse equipment. At the time of the consolidation of the railways he was put in charge of the shops and horse equipment of the West End Company. His duties ceased, however, when the electrics were installed, and he was made night starter at the Gainsboro-Street stables. After those stables were closed he was transferred to the Brookline stables, but a few months later, September 4, 1898, was appointed Superintendent of the Fourth Division of the Boston Elevated Railway Company, his office being on Eagle street, East Boston.

The Fourth Division is located in East Boston, which is an island, so that it is practically an independent road, having its own power house, as well as car house, track, etc.

Mr. Esty is married and has one son.

THE FIFTH DIVISION.

The Fifth Division of the Boston Elevated Railway Company is a busy division, its cars going to points on all the other surface divisions, with the exception of that of East Boston, and the chances are good for them to reach that section when the East Boston tunnel opens up for business. Mr. Frank W. Damon is the efficient superintendent of Division Five, with headquarters on P street, South Boston. Mr. Damon has been railroading for about 19 years, having been promoted several times. Mr. Damon was born in Scituate, Mass., forty-eight years ago, and attended the local schools and seminary at East Greenwich, R. I. After leaving the latter institution of learning he was connected with his father in mercantile business for a few years. In 1884 he came to Boston and secured a position as driver on the South Boston Street Railroad, Mr. Daniel Coolidge being superintendent of the Company. He was later chosen Instructor of Drivers on the line, there being two competent men employed in this branch of the work. He held that position for two years, and was then appointed Inspector, being located on the street. After faithfully serving in this capacity for about ten years he was located at North Point Station in charge of the men, and as the health of the clerk of the division was failing he frequently filled his place. He was soon after promoted to the position of Superintendent of the Fifth Division of the Boston Elevated Railway, to fill the vacancy caused by the transfer of Superintendent George R. Tripp to the head of the Sixth Division. This promotion was in December, 1900, and since that time he has most ably managed the affairs of the division, which has a trackage of about 14 miles. There are about 400 conductors and motormen employed on the division, and there are 140 open cars and 135 box cars used on the line.

Mr. Damon married Miss Amy Young, of Scituate; they have three daughters, the youngest of which is employed as a stenographer by the Company at its headquarters, 101 Milk street, Boston. Mr. Damon and family reside in South Boston.

THE SIXTH DIVISION.

Mr. George R. Tripp was appointed Superintendent of the Sixth Division on December 27, 1900, and has headquarters at the Sullivan Square terminal. There are about 1000 men employed on the Sixth Division, 600 of the number being conductors and motormen. There are between sixty and seventy miles of track in the division, which extend over the streets of Charlestown, Everett, Medford, Malden and Somerville. There are three stations in the territory covered by the Sixth Division, and over four hundred box and open cars constitute the rolling stock.

Mr. Tripp was born in Kennebunk, Me., April 25, 1858, and attended the local schools of that town. For four years he worked in a local shoe factory and came to Boston when he was 22 years of age. Hiring out as conductor on the Cambridge Street Railroad, he run from Cambridge to Boston. After serving as conductor for three years he was promoted to the position of starter, and served for four years, when he was appointed superintendent of stables, Gen. Bancroft then being superintendent of the Cambridge road. Mr. Tripp had general charge of 1800 horses in the stables and supervision over teaming and the sale of disabled horses. At that time fully forty horses were kept busy doing teaming for the road. He also attended to the inspection of hay, and altogether he was kept very busy attending to his duties. Being recognized as a thoroughly competent street railway man, he was then appointed superintendent of the South Boston division of theWest End Street Railway Co. under General Manager Monks. He was very popular with the 500 employes of the division during his eleven years' service as superintendent. In 1900 Mr. Tripp was appointed superintendent of the Sixth Division of the Boston Elevated Railway, to fill the position made vacant by the resignation of Division Superintendent Richard T. Laffin, who became general manager of the Worcester Consolidated Street Railway Co. Mr. Tripp's headquarters were formerly at City square, Charlestown, but after the construction of the "L" road they were removed to the Sullivan Square terminal, where most commodious quarters are maintained.

THE SEVENTH DIVISION.

The Seventh Division of the Boston Elevated Railway Company is the largest division in the Elevated system. It comprises all of Cambridge, Watertown, Arlington and Belmont, the larger part of Somerville and a part of Newton. It has about 90 miles of track, 374 box and 370 open cars, 8 car-houses, 4 of which are located in Cambridge, 2 in Somerville, and 1 each in Arlington and Watertown, and there are 1,150 conductors and motormen constantly employed.

Mr. John J. Horgan, Superintendent of the Seventh Division, was born in Lexington in 1852, and after leaving school commenced his railway career in February, 1875, as a conductor for the old Cambridge Railroad Company. Mr. Horgan took fares until 1883, when he went on to street as an Aid, that being the title at the time. He was a Starter in Harvard Sq. for a time during the period when General Bancroft was Superintendent. This was during the strike in 1887 and he filled that position from fall until the following spring, when he again went back on to the street as an Aid.

In 1889 Mr. Horgan was again promoted, this time to the position of Chief Inspector, Mr. D. F. Longstreet being General Manager, and Mr. R. Hapgood, Superintendent of the Cambridge Division of the West End St. Ry. Co. On Nov. 1st, 1901, Mr. Horgan was again advanced, being made Superintendent of the Cambridge Division, Superintendent Pasho having been transferred to the superintendency of the "L" Division. Mr. Horgan makes it a point to visit some part of his division every day, either going to some of the car-houses or riding over some of the various lines. Mr. Horgan's headquarters are in Harvard Sq., Cambridge, where he is very pleasantly located. Mr. Horgan is married and lives on Carlisle St., Cambridge.

THE EIGHTH DIVISION.

The Eighth Division of the Boston Elevated Railway Company is known as the Central Division, the tracks going through the city proper, while the Subway is a most important part of the Division.

Mr. Charles W. Hawes, Superintendent of the Eighth Division, was born in Troy, Me., in 1850. Shortly after leaving school he worked on his father's farm, and later drove horses on race-tracks. When about 19 years of age he commenced street railroading, his first position being conductor on the Lynn & Boston Road. When the Highland Street Railway opened up for business in 1872, Mr. Julius E. Rugg, then Superintendent of the Lynn & Boston Road, was appointed Superintendent of the Highland, and Mr. Hawes went with him to that road. Shortly afterwards he was appointed Inspector, and remained in that position until 1890, when he was promoted to Superintendent of the Eighth Division of the Boston Elevated Railway. The Division is an important one, as the hundreds of cars from the other divisions are to be kept moving, while the Subway is an important factor. In any one hour of the day there are 1,150 cars on the rails of the Eighth Division. There are 80 switch and junction points, and about 160 men are employed. This includes Inspectors, Starters, Switchmen, Electricians, etc. There are no car barns on the division, yet the cars that come from the other divisions, passing as they do, through the business section of the city, make Superintendent Hawes and the men under him busy nearly all hours of the day and night. Mr. Hawes has direct supervision of the Park street station in the Subway, where, over one rail, five cars pass every minute.

Superintendent Hawes' office is at 101 Milk street, in the building occupied by the general offices of the Company.

THE NINTH DIVISION.

Division Nine of the Boston Elevated Railway Co., with a trackage of about thirty-five miles, the constant running of about 350 cars and the employment of 500 conductors and motormen and 150 mechanics and laborers in the various departments, is a busy section of street railway property, and Superintendent Elmer H. Littlefield can always be found at his headquarters at Allston directing the company's up-to-date methods of street railroading. Mr. Littlefield was born in Georgetown, Mass., Nov. 17, 1847, his father being Moses H. Littlefield. His parents moved to Salem when he was three years of age, and in that city he attended the public schools and graduated from the High School. His parents reside in Salem. The subject of this sketch, after leaving school, worked in a stove and tinware store in Salem and Wakefield, and for a while was engaged in the manufacture of patent spring chairs. In 1870 he came to Boston and received a position as conductor on the Union Street Railway under Superindent Richard Hapgood. He worked several years as conductor and driver on the Union and Cambridge Street Railways. His first promotion was to take charge of the stable at River street. He filled that position until Gen. Bancroft was made superintendent of the road, when he became Superintendent Bancroft's assistant, his labors being the making up of time tables, pay rolls, having charge of the hay and grain accounts and attending to the bookkeeping of the office. He remained with Superintendent Bancroft during his administration, and was with Mr. Hapgood after he returned from the west to again become superintendent. April 9, 1888, Mr. Littlefield resigned and went west to take charge of a street railway line in Topeka, Kan., and during his labors there as superintendent the horse road changed into a successfully managed electric road, it being one of the first electric roads in the country. Mr. Littlefield had charge of the reconstruction of the road. After the consolidation of the two roads in that city, Mr.

Littlefield resigned and went to Oklahoma, Sept. 16, 1893, at the time of the opening of that country. He started a stock ranch, was very successful, and remained there until Dec. 27, 1898, when, on account of the death of his wife, he decided to come east and be near his children. Upon his return he was made inspector of buildings for the street railway company, and upon the resignation of Superintendent Fred H. Stearns of Division Nine he was promoted to fill the vacancy on April 5, 1899, and has since most acceptably filled the position. There are three stations in the division, Allston, Oak Square and Reservoir.

Bureau of Audit.

This department is not listed among the departments in charge of the vice-president as given elsewhere, but is conducted under the supervision of Mr. H. L. Wilson, who is responsible directly to the president and board of directors. The offices of this department occupy the entire sixth floor of the department building and are elaborately furnished with all the necessary desks, cabinets, cases, and safes for the care and handling of the records. The clerical force consists of 44 clerks, all but two of whom are men. Two women stenographers and typewriters are employed. In the conduct of the business, the library card system prevails. For readily shifting the heavy books, some of the shelves in the large safe are provided with iron rollers so that the books can be easily slid in or out of place. Some idea of the detail work which this department is required to handle can be formed when it is stated that last year the department paid 18,000 vouchers. The company furnishes blanks on which all bills are made, so that the vouchers are all uniform and can be filed in uniform packages. The pay rolls amount to from $105,000 to $125,000 per week. By a state law, the company is required to pay the employes weekly. Every man is required to sign his name on the pay rolls as a receipt for his money and these rolls are all bound and kept on file. The number of different report blanks which are prepared and furnished by this department and from which returns are tabulated is over 400. On an average, over 3,000 records relating to the operation of the lines are received at the auditor's department daily.

A very elaborate and complete method of accounting is required on the system of the Boston Elevated Railway Co., for the reason that all the property used in connection with the surface lines has been leased from

the West End company. One feature of the records that is of special interest is the inventory record of real estate and all property that the West End company turned over to the Elevated company. These inventory ledgers comprise five large volumes and the method employed is unique and interesting. The first volume is that of the real estate and gives a record of all power houses, car houses, shops and tenement houses belonging to the company, and in connection with each item, there is first a written description on carefully prepared typewritten sheets, and the detail description includes each floor of the buildings. Next follows a ground plan in colors after the manner of keeping real estate records and shows the dimensions of the lots and the buildings and the plan of each floor. Next follows a photograph of the building.

Volume 2 is a record of the track construction, electric line equipment, power station equipment and subway equipment. This is carefully indexed and shows the kind of rail that is used on every street in each of the cities and towns through which the lines run, giving the length in feet, description, and the kind and condition of pavement; there is also a sectional drawing of every kind of rail on the road that existed when the company took possession of the lines. Following this is a description of the different types, and also each piece of special work with a drawing showing the general type of special work, and also the location of each piece, by whom made, when put in, type of rail and the number of feet. There are also separate illustrations, of all girder rail special work, all T-rail special work, and all the special work of tram rail. The inventory of line equipment gives for every street on the system, the size and kind of trolley poles, these being alphabetically arranged by streets, cities and towns. There is also a sketch of the poles in which the dimensions and weight are given. The switch boxes, insulating material, a record of single and double trolley wire, single brackets, double brackets, and span wire, and all the different sizes of feed and return wires and type of wire are also given. A grand summary, showing everything in tabulated form by cities and towns follows. There is also a statement of underground conduits

and cables giving location, length of trench, length of conduit, average number of ducts, and number of feet of ducts, number of connections and manholes, also number of feet of each size of feeder cable and underground returns. This is followed by the submarine, bridge cables, together with the switches and the number of feet and size of wire on bridges. The same volume also contains a description and illustration of all the power station equipment.

Volume 3 contains an inventory of cars, motors, trucks, controllers, and car equipment and also the miscellaneous vehicles. The number of every car is given; when built, by whom, style of car, and a photograph of one of every lot of cars. Then follows a description and drawings of all the different types of trucks, also a description of all the motors, together with controllers, all spare parts, armature spools, etc. The vehicles of all kinds, including coal cars, sprinklers, sleighs, snow plows, etc., are described and illustrated.

Volume 4 is a record and description of the machinery and tools in all the manufacturing and repair departments, together with the furniture and fixtures of the buildings, also a record of horses and harnesses, and in connection with the horses, the register number and age as well as the description are given. The miscellaneous department includes all office furniture, and all tools and machinery of the entire system with location.

Volume 5 describes the material and supplies on hand.

A card is provided for every vehicle showing where it is to be found and all the information about it. The power station expenses are kept on cards, with a record of the coal and oil, there being a card for a record of 12 months, and the different years are so arranged that comparisons are readily made. The card record shows the power consumed for operating the car for lamps and for heaters. A card is provided for the transfer tables, one for the stationary motors and one for the armature record. This armature record shows when the armature was received with all repairs that have been made to it with their cost, number of the car on which it has been run, and cause of removal in each case. The motor

records are also kept on cards, give the car number, the date put under the car, the date on which removed and cause of removal. By this record, the relative economy of the different type of motors is readily found. By the system of reports and accounting used, the auditing department is able to know the cost of any particular piece of work, and can tell the different repair departments what they can do under certain conditions. Twice a month, a report of the receipts per car-mile is made up.

In the auditing department is a ticket chopping machine driven by an electric motor, which is designed to cut up into fine pieces all checks and transfer tickets. This machine is provided with a hopper into which the tickets are thrown and the small pieces are delivered into a large willow basket, and then as scrap they are sold to paper dealers.

Officers of the Boston Elevated Railway Company.

President—William A. Bancroft.

Vice-President—Charles S. Sergeant.

Assistant to Vice-President—Paul Winsor.

Secretary—John T. Burnett.

Treasurer—William Hooper.

Receiving Cashier—E. G. Ware.

General Solicitors—Gaston, Snow & Saltonstall.

Manager Legal Department—Russell A. Sears.

Auditor—Henry L. Wilson.

Chief Clerk—John T. Dwyer.

Chief Clerk Department Accounts—James H. Neal.

Ticket Agent—John H. Studley.

Counsel—George C. Travis.

Real Estate Agent—D. L. Prendergast.

Purchasing Agent—Edward Mahler.

Chief Engineer—George A. Kimball.

Designing Engineer—Robert B. Davis.

BUREAU OF OPERATION.

Superintendent of Transportation—Julius E. Rugg.

Superintendent of Division 1—Joseph W. Moore.

Superintendent of Division 2—Joseph M. Gould.

Superintendent of Division 3—Frank I. Wilkins.

Superintendent of Division 4—Henry H. Estey.

Superintendent of Division 5—Frank W. Damon.

Superintendent of Division 6—George R. Tripp.

Superintendent of Division 7—John J. Horgan.

Superintendent of Division 8—Charles W. Hawes.

Superintendent of Division 9—Elmer H. Littlefield.

Superintendent of Motive Power and Machinery —Charles F. Baker.

Superintendent of Power Dist.—George S. Lawler.

Superintendent of Machine Shops—John L. Mitchell.

Superintendent of Car Equipment Shops—H. M. Ballard.

Superintendent of Car Shops—H. L. Libby.

Chief Mechanical Draughtsman—C. H. Bigelow.

Inspector of Motor Car Repairs—William S. Collins.

Superintendent of Wires—Charles H. Hile.

Superintendent of Tracks—Richard Hapgood.

Trackmaster Division 1—H. E. Trevor.

Trackmaster Division 2—Patrick F. Corliss.

Acting Trackmaster Division 6—M. Gibbs.

Trackmaster Division 7—George E. Bridges.

Trackmaster Central Division—George E. Draper.

Trackmaster Division 9—James C. Hebard.

Civil Engineer—Arthur L. Plimpton.

Superintendent of Buildings—Marrett I. Paine.

Superintendent of Employment—Arthur W. Senter.

Superintendent of Inspection—Clarence E. Learned.

General Storekeeper—Frank T. Lewis.

ELEVATED LINES.

Superintendent—Herbert A. Pasho.

Train Master—George H. Benjamin.

Chief Train Despatcher—Fred H. Orr.

District Supervisor—Harry H. Hanson.

District Supervisor—Samuel E. Walker.

Road Master—Frank C. Stowell.

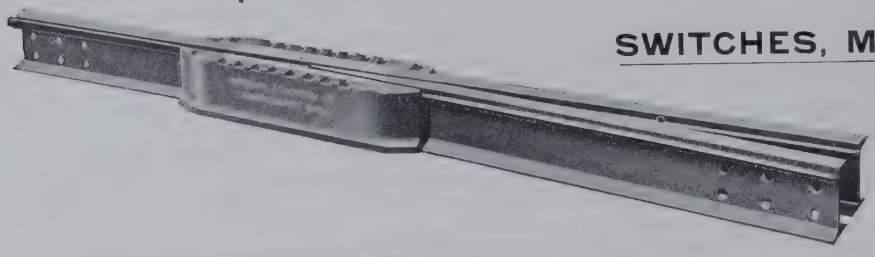
Assistant Roadmaster—William R. Butterfield.

Inspector of Signals—L. Frederic Howard.

General Foreman of Shops—John Lindall.

A Section of the Subway Before Completion.

Special Work for Street Railways



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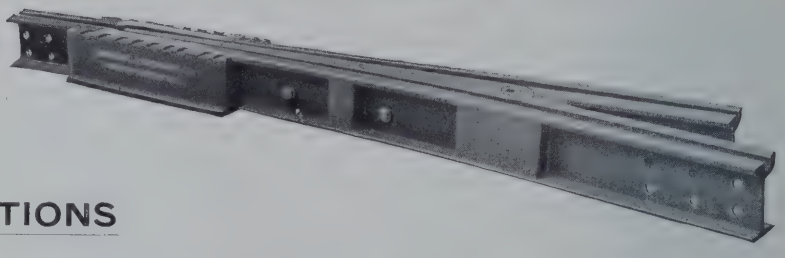
CURVES, CROSSINGS, TURNOUTS AND CROSS CONNECTIONS



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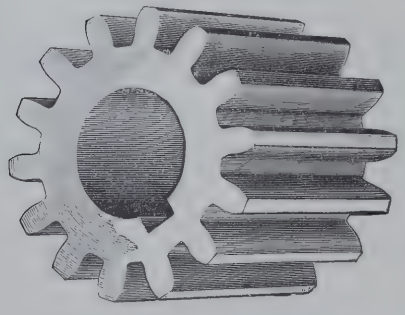
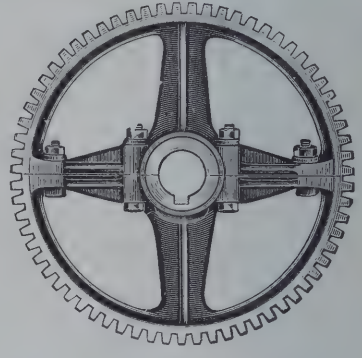


MANUFACTURERS OF



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New York, Manhattan El. Ry. (One Power House)	40,000
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Boston Elevated Railway	12,000
Boston Subway, Scollay Square	40,000
Boston Subway, under Southern Terminal	500,000
Baltimore United Electric R. R. Co. (1 Power House)	103,450
& Extension	103,000
Montreal St. Railway Co.	32,800
Total of Elev. & Subway Ry. Work in 4 cities	1,164,250

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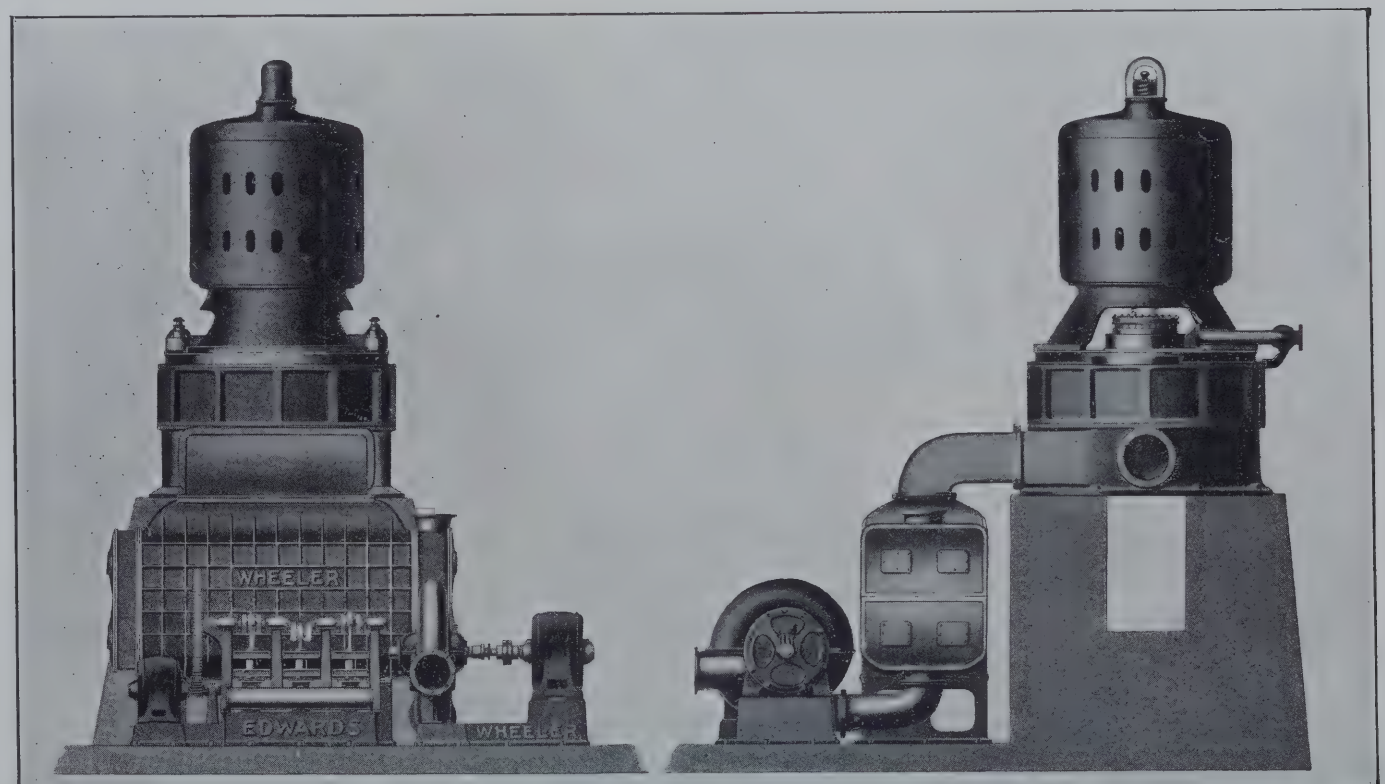

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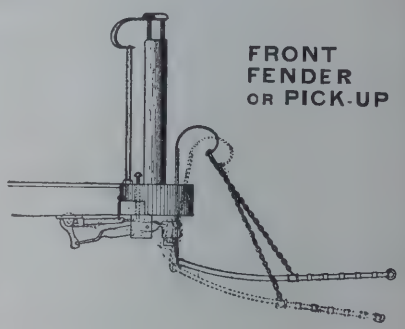

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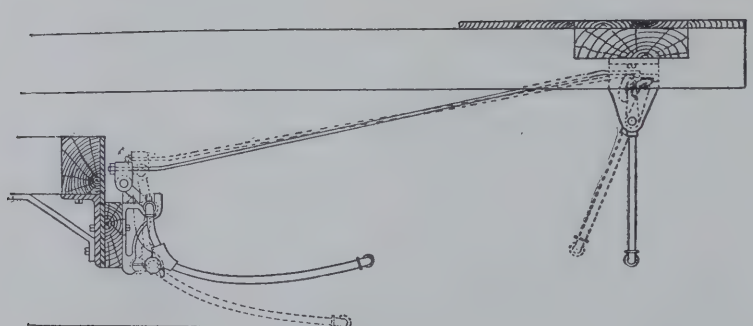

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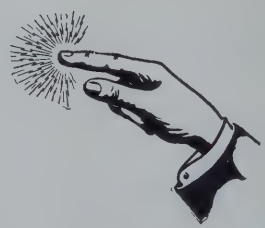

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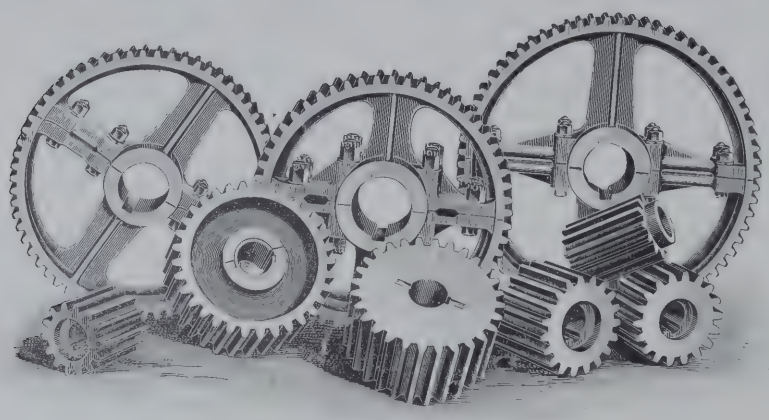

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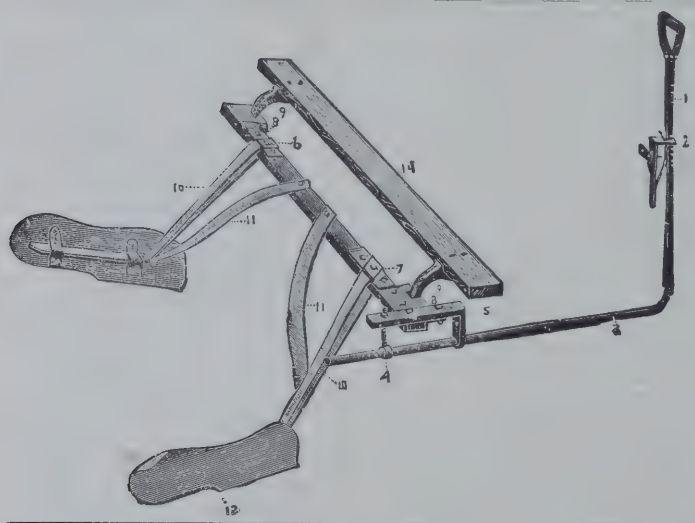

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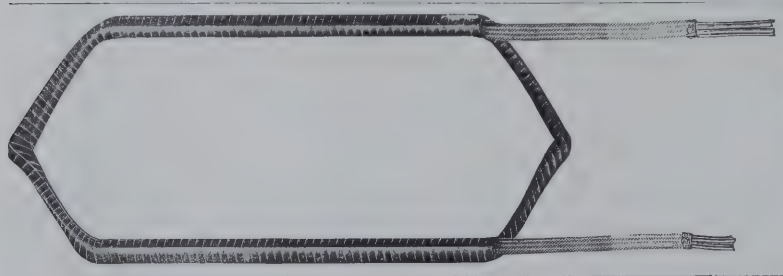

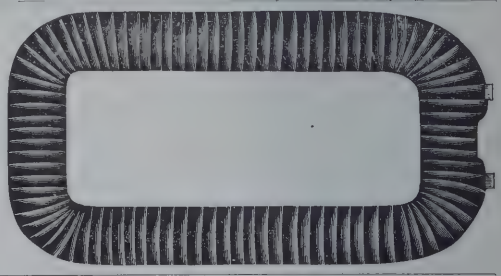

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Milford, Attleboro and Woonsocket St. Ry. Co., Unionville, Mass.,	1000
General Electric Co., Lynn, Mass., 1 Vertical, 600 h. p.; 1 Vertical,	800
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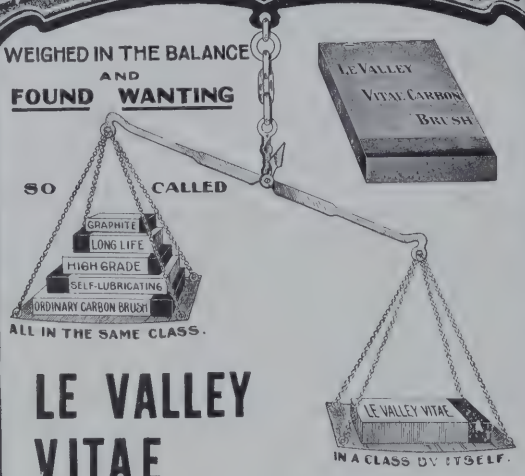

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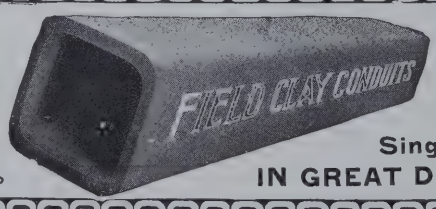

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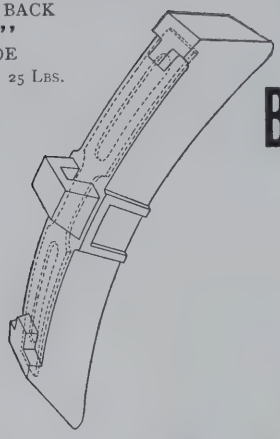
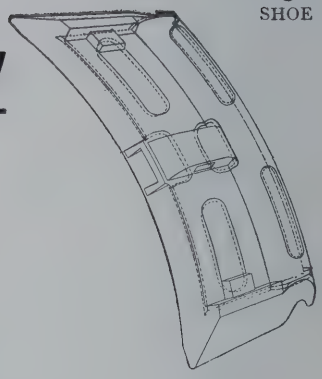


STEEL BACK FLANGED "U" SHOE



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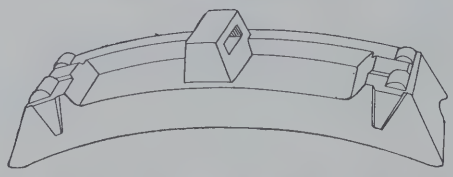

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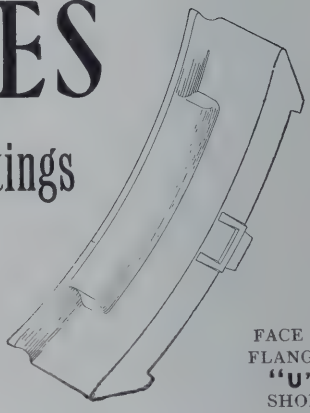

FACE OF FLANGED "U" SHOE

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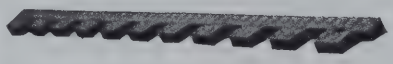
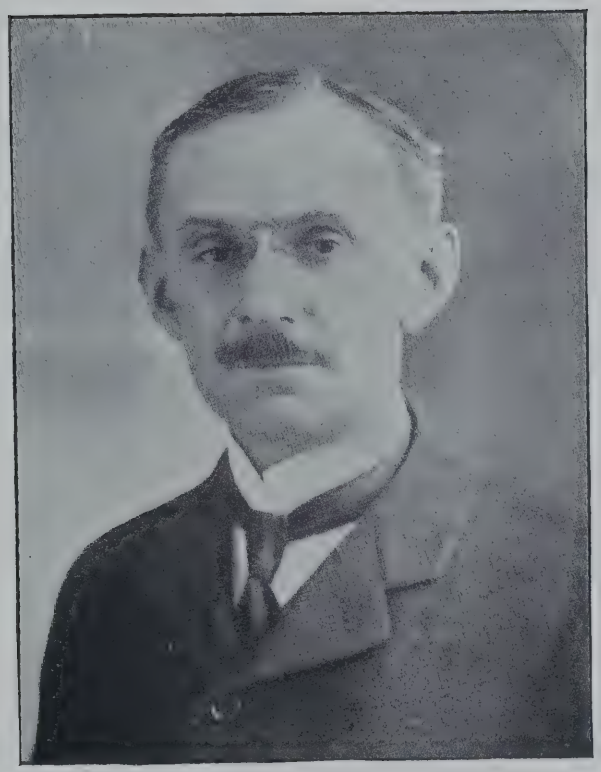


TOP VIEW

THE PROTECTING STRIP

BOTTOM VIEW

PROTECTED PAVING



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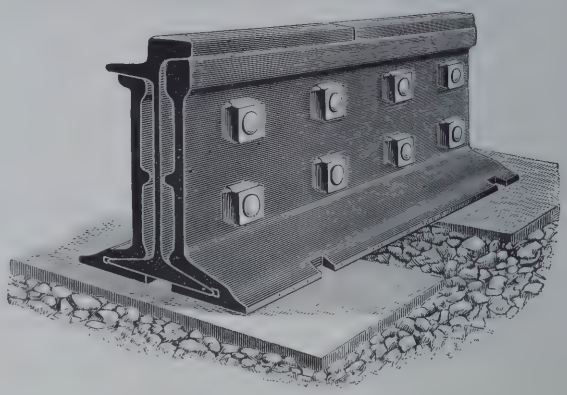

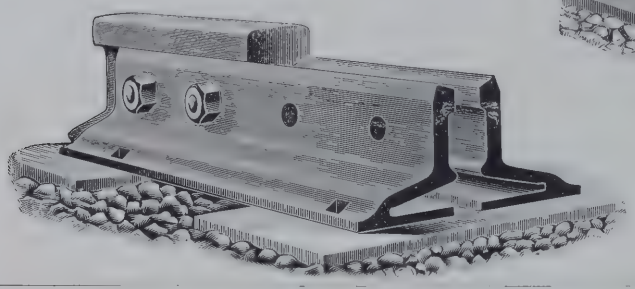

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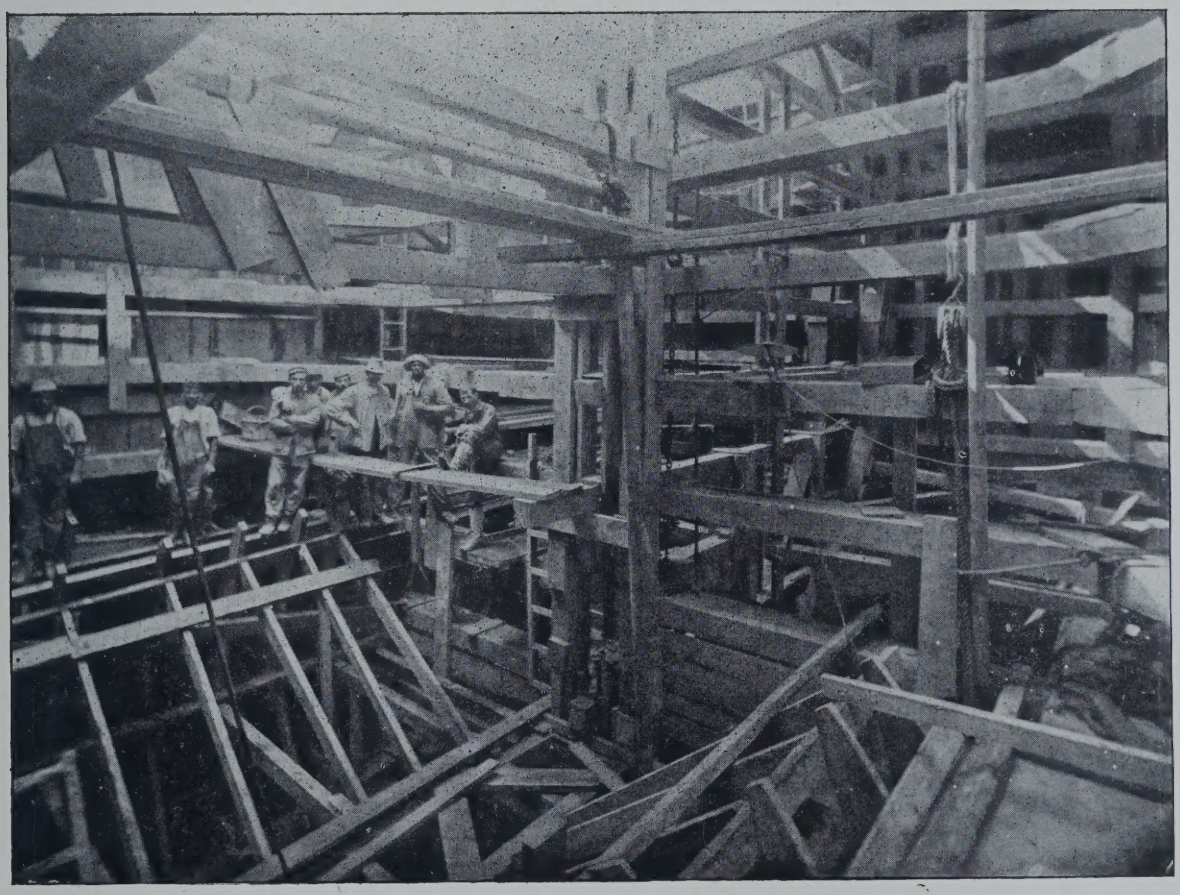

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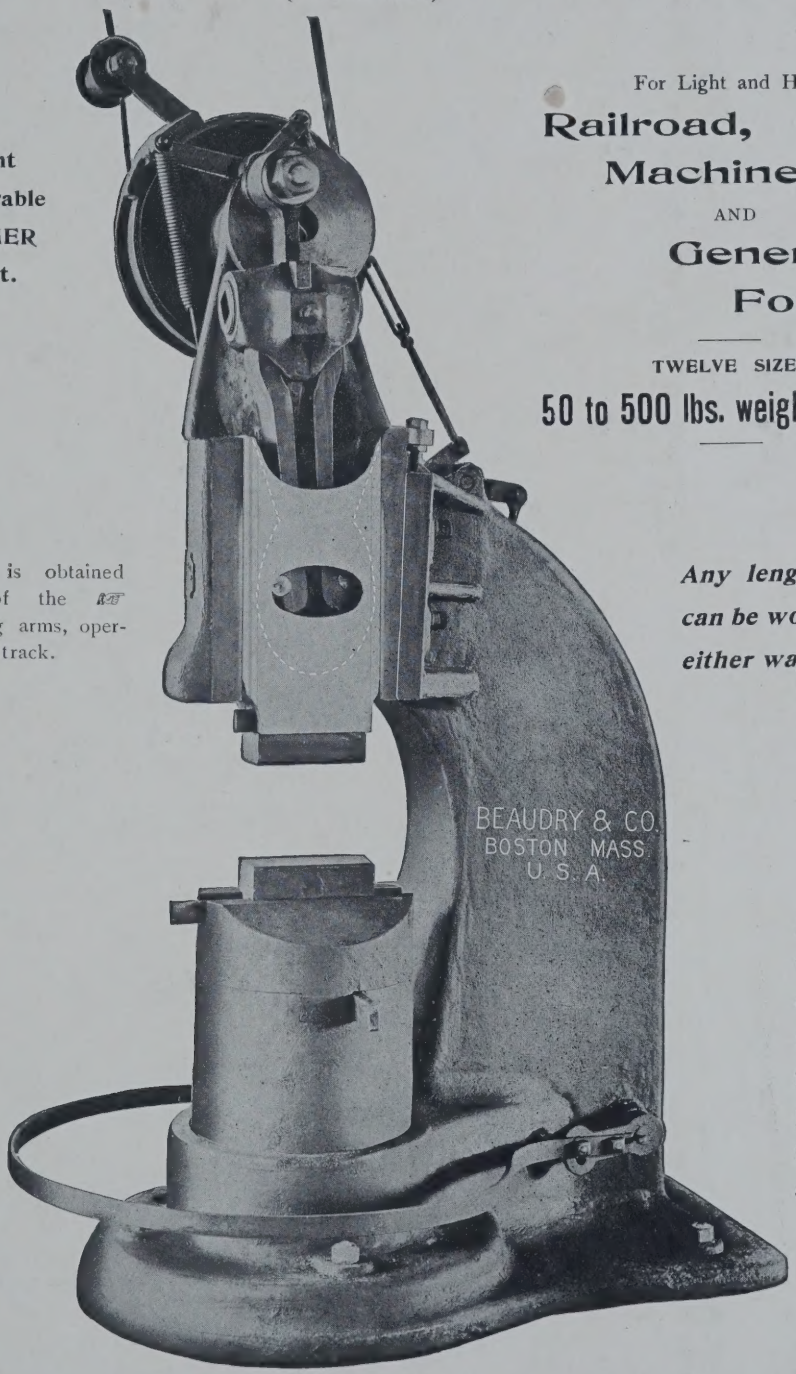

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